Hatch Mott
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PORT ALBERNI TRANSSHIPMENT HUB PRE-FEASIBILITY STUDY

Final Report

Prepared for:

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EXECUTIVE SUMMARY

The Port Alberni Transshipment Hub Pre-feasibility Study was commissioned by Port Alberni Port Authority (PAPA) to analyze the viability of an automated transshipment terminal within the Alberni Inlet. The proposed terminal will be designed to handle 2,500,000 twenty-foot equivalent container units (TEU) annually with the capability to receive the largest trans-pacific container vessels (up to 22,000 TEU). Imported containers will be shuttled to ports in the Pacific Northwest by feeder vessels and barges, and by trucks for local Vancouver Island traffic (vice versa for exports).

Several locations were identified along the Alberni Inlet as the potential site of the new terminal, which included Sarita Bay, San Mateo Bay, Spencer Creek and Coleman Creek. Opportunities and constraints for each location were initially identified, as well as an evaluation of the earthwork requirements based on two generic terminal layouts. Due to steep terrain along the inlet, 3D modelling was used to determine the manner to best utilize the difficult terrain and investigate the most optimal sites from an earthworks perspective. As a result, the Sarita Bay area, with its North and South sites, is preferred due to the significantly lower earthworks involved. One of the two generic layouts at the North site has been abandoned due to the excessive earthwork required to make it feasible, thus leaving three options for further refinement.

A static operational simulation model was prepared to determine throughput and capacity potential based on a series of planning criteria parameters, developed between HMM and PAPA. The equipment required for the terminals include double trolley tandem lift ship-to-shore quay cranes, automated guided vehicles, automated rail mounted gantries, automated stacking cranes, and optical character recognition (OCR) equipped gate systems.

Following this, for each of the chosen sites, the initial generic layout was further refined to each site to provide General Arrangements and details consistent with preliminary engineering in order to generate Order-of-Magnitude cost estimates. Results from the cost estimate ranges from $1.63 to $2.05 billion for the three options. The estimates suggest that development at Sarita Bay South is initially the most financially favourable, however further investigation will be required to confirm geotechnical conditions as well further modelling such as dynamic operational simulation to analyse and confirm operability and feasibility due to the complexity of an automated terminal.

The next steps for the project will include undertaking a feasibility level study which would focus on costs, permitting, environmental impacts, project and construction execution, contracting strategies, and refinement of the design through advanced analysis such as dynamic operational simulation. It is recommended that the Port Authority proceed with the next level of design to minimize the risks involved with the project.

1 PROJECT OVERVIEW

1.1 SUMMARY OF STUDY

Hatch Mott MacDonald (HMM) was tasked by the Port Alberni Port Authority (PAPA) with undertaking a pre-feasibility study for a transshipment container terminal development within the Alberni Inlet. Known as the Port Alberni Transshipment Hub (PATH), the facility is planned to enhance trade opportunities in the Asia-Pacific Gateway Corridor by creating a terminal for the largest trans-pacific container vessels to service North America. Smaller vessels will trans-ship containers from Port Alberni to 'local' Canadian and American Ports on the west coast.

The study involved assessing the feasibility of various key sites along the inlet to determine their viability for development and ultimately selecting up to three options for further investigation. An assessment of the selected sites was undertaken, in addition to static simulation modelling to determine potential throughputs and storage capabilities given the available land constraints. Order-of-Magnitude cost estimates were undertaken for the selected sites to provide PAPA with the necessary level of detail to request funding to further investigate the options.

1.2 DESCRIPTION OF STUDY AREA

The Alberni Inlet is a long narrow inlet stretching from the Pacific Ocean at Barclay Sound on the west coast of Vancouver Island, about 40 km inland terminating at Port Alberni. For the most part, the inlet averages approximately 1 km wide along its length. The inlet is an extremely deep channel, making it suitable for the largest of current and forecasted container vessels.

Both sides of the inlet are characterized by steep sided, tree-lined rocky slopes, extending up to 300-400 m in some areas. Save for the occasional remote coastal home, a log sort facility at Sarita Bay, and some small-scale logging operations, the area is undeveloped. Figure 1-1 below shows the typical landscape along the inlet.

FIGURE 1-1 TYPICAL INLET LANDSCAPE

Land ownership along the inlet consists of a combination of Crown Lands and First Nation's Treaty Lands managed by the Huu-ay-aht First Nation.

2 IDENTIFICATION OF SITES

The following sections outline the sites chosen to be investigated as part of this pre-feasibility study and the short-listing/selection of the key sites for further conceptual development.

2.1 SITE DESCRIPTIONS

Site selection for this study consisted of a combination of a prior investigation by PAPA and an assessment on behalf of the Huu-ay-aht First Nation undertaken by KPMG (*Container Terminal Site Assessment, November 28, 2013*).

At the start of this study it was decided by PAPA to concentrate study efforts at the following locations:

- Coleman Creek;
- Spencer Creek; and,
- Sarita Bay (also known as Numukumis Bay).

During a site visit of the above sites undertaken by Hatch Mott MacDonald and PAPA on January 8, 2014, Sarita Bay was noted as having a number of potentially suitable locations. As such this site was further broken down into Sarita Bay North and Sarita Bay South. During the visit, San Mateo Bay was also identified as an area to be investigated further.

The following shows the relative positions of these sites along the eastern shores of the inlet. Drawing 329510-GA-100-S0-0001 included in Appendix A also shows an overview of the Alberni Inlet and selected sites.

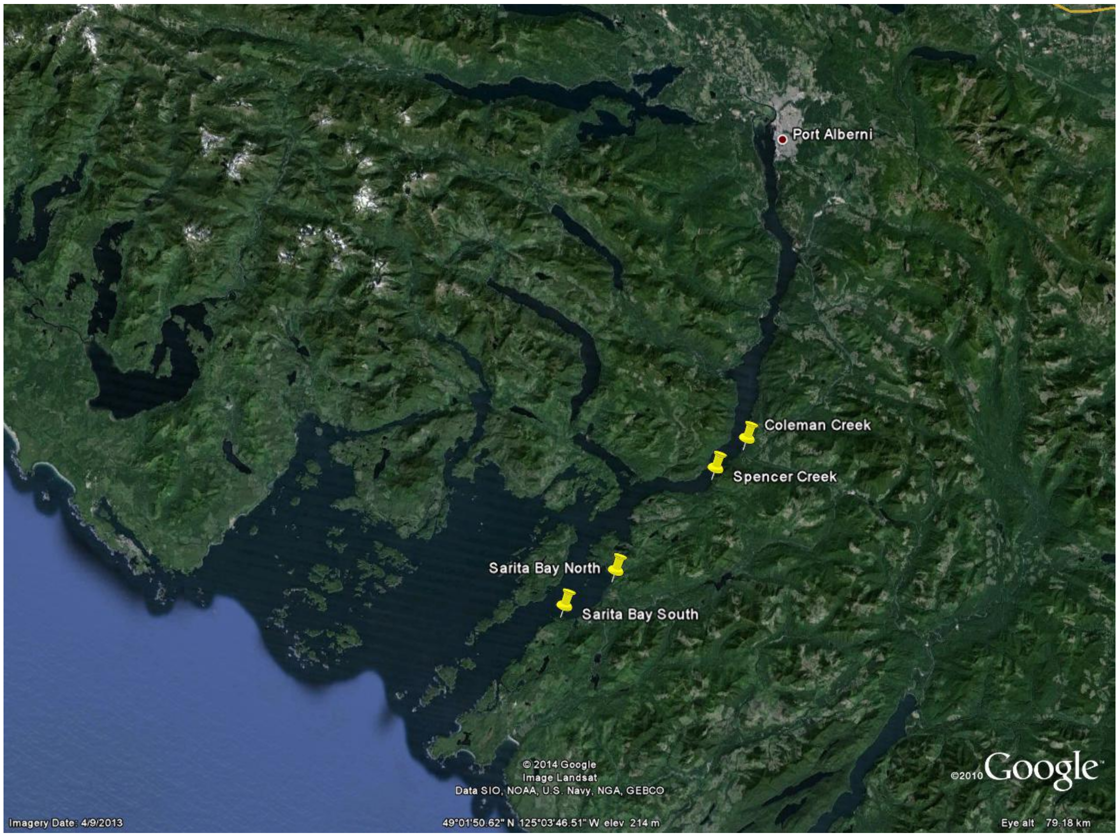


FIGURE 2-1 POTENTIAL STUDY LOCATIONS (GOOGLE EARTH, 2013)

The format for the site selection would initially take the form of an Opportunities and Constraints review of each site, identifying key geographical features that would make the site either suitable for further investigation or not.

2.2 OPPORTUNITIES AND CONSTRAINTS REVIEW

The Opportunities and Constraints review consisted of a combination of both a desktop study and visual inspection undertaken on January 8, 2014 by marine vessel along the inlet. The data sources for the desktop review were as follows:

- Aerial photos - Google Earth;
- Topographic information - Base Mapping and Geomatic Services (BMGS), Integrated Land Management Bureau, British Columbia, Canada. Map tiles:
  - 092c14;
  - 092c15; and,
  - 092f02.
- Chart data – Canadian Hydrographic Service charts 3668 and 3671; and,
- Bathymetric data – Canadian Hydrographic Service.

Drawings 329510-GA-100-S0-0002 to 0006 in Appendix A show the opportunities and constraints identified at each location.

The following sections outline the key findings for each site.

2.2.1 Sarita Bay South

Generally, Sarita Bay is a fairly protected bay area suitable for larger vessels. There is an existing forestry road network providing access to the area. There is also a considerable amount of land available for development. Some of this available terrain incorporates land that belongs to the Huu-ay-aht First Nations who, in general are supportive of the PATH project.

The topography of the land however is such that the design of a terminal facility will require careful consideration to avoid some of the larger peaks in order to develop a sufficiently large area for a development. In addition, the foreshore generally consists of a steeply graded sea-bed dropping off into deep water which provides limitations to the construction of a wharf.

The Poett Nook inlet is an ideal inlet for the presence of a feeder berth as vessel traffic would not impact the larger trans-pacific vessels, however the existing marina and campground highlights the area’s public usage which could be an issue for development further down the line.

Fortunately, the coastline of Sarita Bay South is such that future development is possible given careful consideration for orientation and layout.

2.2.2 Sarita Bay North

Similar to Sarita Bay South, Sarita Bay North has steep sides with some high peaks that will generate significantly high earthwork volumes when levelled. Orientation of a layout at this site will require careful consideration to minimize the earthwork cut volumes.

The presence of an estuary/marsh land in the area provides both an opportunity for development but may also be a limiting factor to design. The low lying area provides the opportunity to excavate the soft ground and backfill with rock to provide the terminal platform. This eliminates excessive blasting of rock that is required at other sites. However, development in this area may not be environmentally advantageous and could be met with either opposition or strict habitat compensation requirements.

The foreshore in this area is generally shallow and void of excessively steep sections which are otherwise disadvantageous to the construction of a wharf.

Again, like Sarita Bay South the land ownership in the area is largely that of the Huu-ay-aht First Nations.

2.2.3 San Mateo Bay

The San Mateo Bay site offers two potential areas for development, one on the eastern shore and the other on the west. The location of it is such that the area is well protected from tides and waves which offer advantages for a deep sea terminal. The disadvantage to this however is that there is limited water frontage available for development of the berths, without having to build out into the main inlet. Also, the narrowing of the bay on its south side provides restrictions to vessel manoeuvrability.

Other constraints at this site include steep topography and high peaks which would require extensive earthworks; and the presence of May Lake that would need to be backfilled which may require extensive environmental applications.

The site however does have good road access in the form of Rutherdon Road which is a factor for consideration.

2.2.4 Spencer Creek

The Spencer Creek site is much like the other sites being investigated as part of this study in that it would require extensive excavation of the steep topography to provide a sufficiently large, flat pad for development. The deep and steep rocky foreshore area will also provide limitations to the construction of a wharf due to the difficulties with being able to form a flat seabed off which to construct caissons from.

The opportunities with this site stem from the wide coastal front that provides suitable width to be able to develop the terminal, in addition to allowing for future expansion potential should this become a requirement. Road access to this area also exists which is a requirement for truck traffic.

2.2.5 Coleman Creek

The Coleman Creek site, located the furthest north of those locations within the study area is similar to Spencer Creek in that it offers a wide area for development opportunities. However, this may be limited by extensive excavations to level the high peaks, some in excess of 575 m, located on the western side of the site. In addition, Coleman Creek on the eastern side of the site potentially limits expansion opportunities.

The foreshore in this area is similar to the land topography in that the seabed drops off quickly into deep waters which could limit the ability to construct a wharf.

Despite the topography of the site, the main opportunity is with the presence of a forestry access road that provides road access directly to the area.

2.3 SITE SELECTION

2.3.1 General Site Earthworks

Following identification of the opportunities and constraints it became apparent that each of the sites possessed similar characteristics that offered both potential for development as well as limitations. The topography of the whole inlet, including the foreshore areas are such that earthwork requirements would be the main variable. As such, the basis for site selection would be the cut and fill quantities.

Generic concept layouts were developed (refer to Section 3 for further details) which provided two distinct area requirements. One of the concepts, option A (Figure 2-2), included feeder berths that would be perpendicular to the main berths on either side. The other, option B (Figure 2-3), included the feeder berths parallel to the main berths.

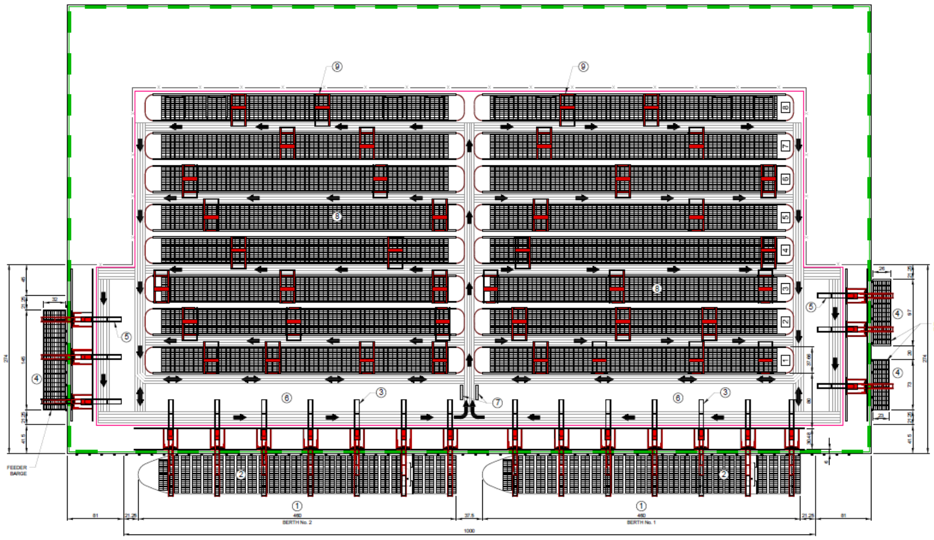


FIGURE 2-2 CONCEPT OPTION A LAYOUT

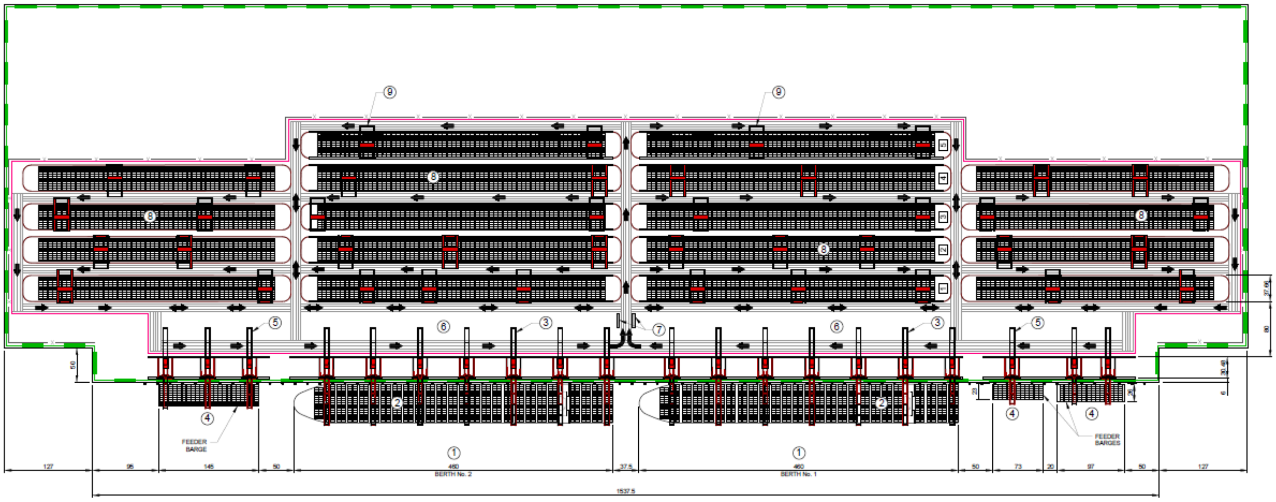


FIGURE 2-3 CONCEPT OPTION B LAYOUT

For comparison purposes, these two generic layouts were overlaid onto each site in the best possible configurations to determine approximate cut and fill earthwork quantities. The finished grade was set at +7 m above chart datum.

The results of the earthwork analysis are summarized in Table 2-1 and Table 2-2 below:

TABLE 2-1 OPTION A ORDER-OF-MAGNITUDE EARTHWORKS

		Total Volumes, m^3		
Site Name	Site Area, m^2	Fill	Cut	Net Volume, m^3
Sarita Bay South	885,550	687,000	39,634,000	38,947,000
Sarita Bay North	885,550	3,500,000	8,372,000	4,872,000
San Mateo Bay	885,550	557,000	51,817,000	51,260,000
Spencer Creek	885,550	63,000	114,727,000	114,664,000
Coleman Creek	885,550	81,000	48,951,000	48,870,000

TABLE 2-2 OPTION B ORDER-OF-MAGNITUDE EARTHWORKS

		Total Volumes, m^3		
Site Name	Site Area, m^2	Fill	Cut	Net Volume, m^3
Sarita Bay South	1,240,730	7,953,000	18,349,000	10,396,000
Sarita Bay North	1,240,730	4,127,000	15,229,000	11,102,000
San Mateo Bay	1,240,730	1,921,000	48,976,000	47,055,000
Spencer Creek	1,240,730	755,000	133,950,000	133,195,000
Coleman Creek	1,240,730	825,000	72,421,000	71,596,000

The outcomes of this exercise demonstrated that the earthwork cut quantities at the two Sarita Bay sites are considerably lower than San Mateo Bay, Spencer Creek, and Coleman Creek sites. As such it was concluded that further development would only be focussed on the Sarita Bay sites as they present the most economically feasible locations within the study area.

Furthermore, an analysis of the grading models comparing the North and South sites at Sarita Bay showed that, despite lower overall grading requirements for option A at Sarita Bay North, dredging requirements were generally lower for layout option B. This was due to the additional excavation into the hill sides to create feeder berth pockets for option A. As dredging is considerably more expensive to undertake than on-land rock blasting and excavation, it was concluded to proceed with investigating suitable concepts at Sarita Bay that took a form similar to option B.

Following this short-listing of the sites, the layouts were further refined as described in Section 3.8 to suit the dimensional requirements, topography, and orientation of each location to optimise both on-land excavation and dredging requirements.

3 TERMINAL PLANS

3.1 MODE OF OPERATION

PAPA is proposing a new and novel way of handling the trans-pacific container trade to the Pacific Northwest (PNW) of North America. Although the concept of transshipment may be new to the region, it is a proven and effective logistics practice throughout the world. The current trade has vessels making multiple ports of call once container ships arrive in the region. PATH will alleviate these multiple calls thereby allowing for the largest container ships the opportunity to make one call in the PNW and then return to Asia permitting for an efficient use of the vessel and associated service strings.

However, the transshipment model does introduce an intermediary port call and therefore additional on-shore handling. As a result, for transshipment to be effective, onshore handling at the intermediary port (PATH) and destination port (Vancouver, Seattle, Tacoma, etc.) must be highly efficient and cost effective so as to minimize port handling charges.

The efficiency and cost of onshore handling of containers is generally dictated by the operational model adopted for the terminal, and its integration with the physical site which leads to the terminal plan. There are numerous modes of operation available to ports and operators, and these can be generally categorized as Conventional, Semi-Automated and Automated. Conventional terminals utilize manned equipment such as top-picks, reach stackers, straddle carriers, rubber tyred gantries (RTGs), etc. A degree of automation can be introduced but the equipment maintains an operator. Semi-Automated terminals generally refer to facilities in which the container yard (CY) equipment is automated and thus no operator is needed except remotely for exceptions.

A fully automated facility introduces automation to the wharf-side operations, the horizontal transport between the berth and CY, and possibly between the CY and intermodal yard (IY); however, no IY has been included for these sites. The result is a person-less central terminal area that can be efficiently optimised to provide continuous production and reduced operating costs. Added benefits include improved worker and cargo safety, mitigation of environmental impacts, particularly emissions, and enhanced energy utilization. This is accomplished by the electrification of automated equipment, the following of efficient travel routes, reduced terminal lighting, and near elimination of unnecessary accelerations/decelerations.

Although there are roughly 1,400 container terminals worldwide, only about a dozen are automated. More and more terminals will move toward automation now that the industry has recognized the benefits of the proven technology. In North America the first fully automated terminals are under construction in the Ports of Long Beach and Los Angeles while automated facilities are being planned for the Ports of Montreal and Vancouver.

As a result, it is anticipated that PATH will be a fully automated facility to ensure a smooth, efficient, and cost effective transfer of containers between the primary trans-pacific trade vessel and local feeder traffic.

3.1.1 Terminal Equipment

Thus the mode of operation for PATH will include the following equipment:

- Double trolley ship-to-shore Quayside Cranes (QC) will be used at the berths. The main trolley will be manned at the crane or remotely for the discharge and loading of vessels. An inbound container will be offloaded and set on a platform between the crane legs where the twist locks can be removed. A second trolley, that is automated, will transfer the container to the back reach area and loaded onto an automated vehicle. The reverse will occur for outbound load backs.

FIGURE 3-1 TYPICAL CONTAINER AUTOMATED GUIDED VEHICLE

- Automated Guided Vehicles (AGVs) or Automated Straddle Carriers (AutoStrads) will transfer containers between the berth back reach area and the CY. An AGV can be seen in Figure 3-1 while an AutoStrad can be seen in Figure 3-2. The primary operating difference between the two is the QC trolley must wait for an AGV before it can set down or pick up a container. This is not necessary with an AutoStrad which can pick up imported containers from the ground or leave the export containers for the QC to load.

FIGURE 3-2 AUTOMATED STRADDLE CARRIERS

- The CY container stacks will be serviced by automated overhead gantry cranes known as Automated Rail Mounted Gantries (AutoRMGs) or Automated Stacking Cranes (ASCs). An ASC can be seen in Figure 3-3. The AutoRMGs or ASCs handle all movements in the CY including the transfer to and from the AGVs or AutoStrads, stack digging and placement, CY sorting, etc. All operations will be controlled by the Terminal Operating System (TOS) without manned intervention, with the exception of unexpected events or emergencies where remote clerks will have the ability to override the controls.

FIGURE 3-3 AUTOMATED STACKING CRANES IN OPERATION

3.1.2 Stack Orientation

Almost every existing automated container terminal orientates the CY stacks perpendicular to the berth as seen in Figure 3-4. The reason is twofold. First, early AGV technology sought to limit the travel of the AGV and thus less complex algorithms were required to control the vehicle. Second was to move manned operations to the back side of the CY, i.e. truck loading, movement to the IY, etc. The disadvantage of the perpendicular stack was the need to use heavy overhead gantries (RMGs and ASCs) to do most of the horizontal transport in the CY in addition to its primary task of container stacking and retrieval.

FIGURE 3-4 PERPENDICULAR STACK IN AUTOMATED TERMINAL

This thinking is now changing – as AGV and automation technologies advance, it is easier to instruct AGVs to travel longer and more complex routes. By orientating the CY parallel to the berth, similar to the preferred conventional mode of operations, the AGV can do the work of horizontal transport and the ASCs can concentrate on stacking, retrieval, and sorting of containers. It is more efficient to move 80 tonnes of steel around than 300 tonnes of steel. Parallel orientation will also reduce the number of ASCs needed since they can undertake more productive lifts per hour, although more AGVs are needed.

In addition, as PATH is a transshipment rather than a gateway facility, the parallel orientation of the CY is particularly well suited since most containers are moving from the berth to the CY and back to the berth. There is limited truck gate traffic and no IY (no rail intermodal operations were included in the design). Conversely, a perpendicular CY orientation would require the ASCs to move many containers to the back of the stacks away from the berths and then bring them all the way back later. As a result, the plans for PATH are based on a parallel CY orientation.

3.1.3 Truck Loading Process

For locally generated traffic on Vancouver Island, AGVs or AutoStrads will deliver import containers from the CY to a truck loading area. Here multiple purpose-built cantilevered RMGs will retrieve the containers and move them to an adjacent area where trucks back into designated lanes and are loaded by the RMGs. The reverse will be so for exports. The retrieval and placement of containers with the AGV will be automated while final pick up or placement on trucks will be handled by remote operators.

3.1.4 Operational Personnel

This level of automation will require a high level of qualification and intellect of the personnel working in the control centers. Planning personnel such as ship, yard, and truck gate planners will be necessary to focus on enhanced capacity but also planning quality and data accuracy. Control personnel, including dispatchers, process supervisors and controllers, will be necessary to analyze processes and monitor operations to ensure smooth and efficient operators plus deal with exceptions. With remote operations the entire team comes together in the control center as opposed to scattered throughout the terminal and thus, the facility is optimized by an integrated team of motion, logistics, and maintenance specialists.

3.2 KEY OPERATIONAL PARAMETERS

A set of key operating parameters in the form of a planning criteria was prepared upon agreement of the basic mode of operation and reviewed with PAPA. The planning criteria highlight fundamental physical, market and operations performance indicators that will influence the layout of the facility and determine its throughput capacity. All capacities are reported as Sustainable Practical Capacities (SPC) as opposed to Peak Maximum Capacities (PMC). The SPC is a throughput in which the terminal functions smoothly without congestion, delays and the added costs that result. The PMC can be much higher than SPC but congestion sets in causing service decay, added cost and most importantly, unhappy customers including shipping lines and shippers. A copy of the agreed Planning Criteria is enclosed in Appendix B.

The throughput capacity of a deep sea container terminal is a function of each major terminal component which includes the berth, container yard, truck gate, and rail intermodal yard (if there is one). Numerous factors, or variables, influence the volume of containers that can be handled on a daily, weekly, monthly, and yearly basis.

These factors can be roughly divided into three primary categories: physical parameters, productivity measures, and market conditions. The physical parameters include the physical infrastructure and plant (equipment) of the facility including available yard space, length of wharf, number of truck gate lanes, number of ship-to-shore gantry cranes, and number of yard handling equipment. The productivity measures are generally related to the capabilities of equipment and the labour that operates that equipment. This includes such measures as number of productive gantry moves per hour and the rate at which clerks can process incoming trucks. Productivity is influenced by many factors including labour rules, training, skill, level of automation, etc. plus the physical capabilities of the plant. This leads to the third element, market conditions, which will affect throughput. Items such as ship stow, the mix of imports and exports, the volume of empties, destinations, etc. will influence terminal throughput and are generally outside the control of the port or terminal operator.

It is important to understand these parameters, measures, and conditions to gain a thorough understanding of a terminal's capability to handle throughput. This understanding is in turn critical to laying out and planning a new or reinvigorated facility.

To do so, simulation models are used to both simulate operations that in turn can estimate throughput capacities and also define key physical parameters for planning purposes if the simulation is for a new or reconfigured terminal.

The use of simulation modeling allows for the estimation of capacity based upon a select few or many variables. For the planning of PATH, a static simulation model has been used. Static simulation is a numerical representation of a physical condition under one set of variables at a single point of time, a snap shot if you will. Simple computer based spreadsheets, such as Excel, are often used. The more variables entered, and the more reflective they are of actual conditions, the more accurate the results. **Any static simulation model is only as good as the variables provided.**

The CT Static Simulation Model used for PATH is a proprietary tool that has been developed to estimate annual practical throughput capacity for existing and planned container terminals. More than 35 variables are required for input to reflect the conditions being simulated. Caution is needed as the model is generic in nature and may not always replicate specific conditions at a specific terminal nor does the model simulate dynamic conditions such terminal traffic flows. The resultant terminal annual capacities are estimates only based upon the specific set of conditions entered for each variable.

3.3 TRANS-PACIFIC BERTH OPERATIONS

The annual throughput capacity of the berth is essentially a function of the number of cranes available, the number of hours per year that the cranes can work and the number of productive lifts each crane can perform per hour. In its basic form, the capacity is as such:

$$SPC_{berth} = Number\ of\ cranes \times Annual\ working\ hours \times Gross\ hourly\ crane\ rate$$

The majority of container terminals in Canada average 25 to 30 productive moves per hour (gross crane rate) from their QCs. However, PATH will utilize the most advanced QCs with double trolley tandem lift technology feeding an automated operation. As a result, improved productivity is a given and based on similar facilities and simulations by others, 32 to 40 moves per hours is reasonably expected. As a result 34 moves per hour was adopted for the feeder services and 36 moves per hour for the trans-pacific vessels.

The number of working hours per year is based on:

- The operating hours per day which is the number of days in a calendar year that the terminal is open for business. For PATH, 357.5 days was used based on existing facilities in British Columbia.
- Operating hours per day is the number of hours the terminal operates on any given day except when closed. The facility will be automated so unproductive time between shifts will be minimal so generally the result will be near 24 operating hours per day.
- Berth occupancy is the percentage of time that the berth is physically occupied by a vessel. Container shipping lines, with few exceptions, expect a berth immediately upon

arrival of their vessel. As a result, berth occupancies are generally lower than at most bulk terminals. Generally, single berth terminals see maximum berth occupancies of 40%, two berth terminals 50 to 55% and three or more berth terminals 60 to 65%. However, for PATH the two primary berths are expected to be shared with feeder vessels so for their berth occupancy we adopted for trans-pacific vessels a berth occupancy of 45% while feeder vessels occupy the primary berths an additional 20% of the time for a total of 65%. An occupancy of 60% was adopted for the dedicated feeder berths to achieve the design throughput.

- The percentage of time at berth to gross crane hours is a factor that accounts for time that the berth is occupied just before the QCs begin to operate and after the QCs are finished. This time is usually taken up handling lines and other related duties. The value entered is the percentage of time at which the ship is at berth and can be worked by cranes. It is generally around 90% plus or minus 5% so for PATH 95% is used.
- The net crane factor at berth accounts for the fact that generally more than one crane will work a vessel but they will not all work for the same duration since stowage holds are not evenly matched. A commonly used factor is 85% to 95%. If there are three cranes working a ship, this could mean that the first finishes its holds 70% into the call, the next crane 85% of the call time, and the last crane will go until the vessel is complete. For PATH where 7 to 8 QCs are expected 90% is used.

It is anticipated that PATH will receive the largest container ships afloat as the premise of the facility is to allow shipping lines the ability to deploy their largest vessels, and the economies of scale they realize, to only one port in North America before returning to Asia. At present the largest ships in service are the Maersk Triple E’s at a capacity of 18,000 twenty-foot equivalents (TEUs). Ships in the order of 22,000 TEUs are predicted and thus this size of vessel was chosen by PAPA as their trans-pacific design vessel.

Shipping lines will demand a rapid turnaround time for their vessels and thus it is expected that roughly 6000 lifts will be required in a 24 hour period to serve such large vessels. To achieve this it is determined that 7 to 8 cranes will be needed to work one vessel. After discussions with PATH, 7 QCs per berth was selected for a total of 14 QCs on the primary berths.

Based on the above described operating parameters the two primary berths are expected to handle **2,500,000 TEUs per annum**. This will be 1,250,000 TEUs inbound and 1,250,000 TEUs outbound.

3.4 FEEDER BERTH OPERATIONS

With 2.5 million TEUs of trans-pacific trade, the terminals feeder traffic will be required to handle this same volume minus any expected locally generated Vancouver Island traffic. A market review prepared by PAPA estimates that local Vancouver Island traffic will contribute initially 200,000 TEUs of traffic and growing to 500,000 TEUs per annum.

Therefore the feeder traffic berth operations will initially be required to handle 2.3 million TEUs of traffic. Using the parameters described earlier, most importantly the 20% berth occupancy by feeder vessel traffic on the primary berths, just over 1 million TEUs of the feeder traffic can be handled over the main berths using the 14 proposed QCs. Therefore, separate dedicated feeder berths will be needed to handle the remaining

1.3 million TEUs per annum. Six QCs will be required at the feeder berths based on the adopted planning criteria. It is expected that this will result in two berths with 3 QCs each, one at either end of the facility.

3.5 CONTAINER YARD OPERATIONS

As discussed earlier the automated container yard will consist of container stacks orientated parallel to the primary berths. The PATH CY will be required to handle 2.5 million TEUs of throughput that includes 200,000 to 500,000 TEUs passing between the primary berths and truck handling area and 2.0 to 2.3 million TEUs passing between the trans-pacific vessels and feeder vessels. This is illustrated in Figure 3-5 below.

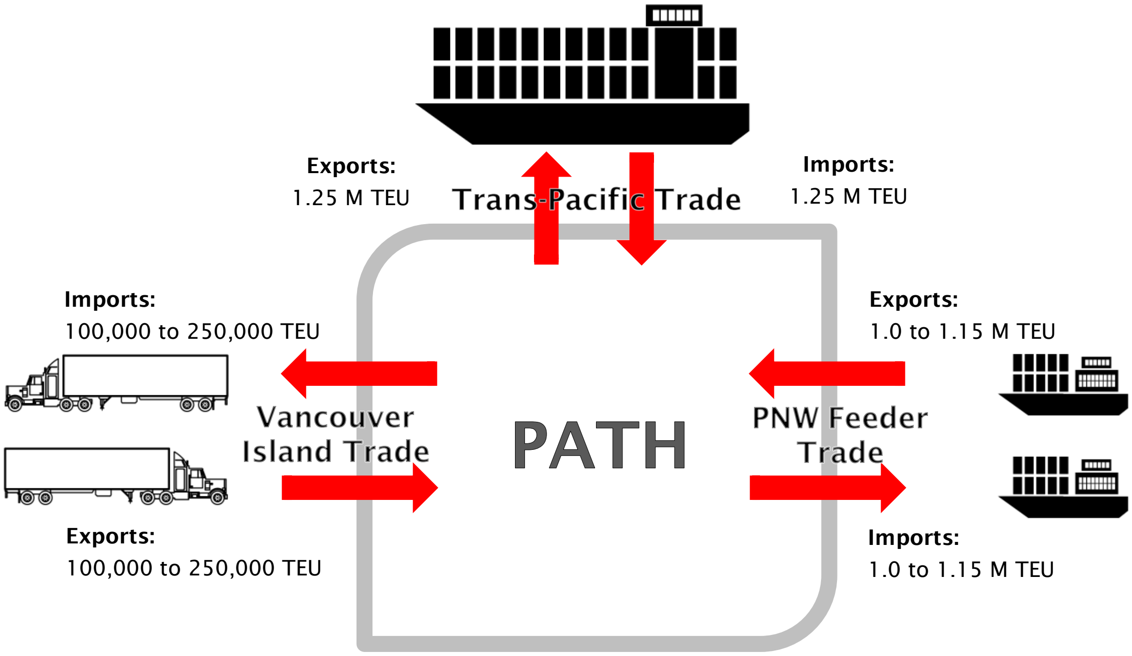


FIGURE 3-5 TERMINAL THROUGHPUT

The throughput capacity of a CY is essentially a function of the number of twenty-foot ground slots (TGS), the maximum practical stacking height, the maximum sustainable density and average container dwell time. In its basic form:

$$SPC_{CY} = Number\ of\ TGS \times stacking\ height \times (365\ days\ /\ dwell\ time)$$

The number of TGS is the value we seek through simulation once other parameters are input to determine the required throughput needed to match the berth throughput.

For PATH it is expected that 1-over-5 AutoRMGs or ASCs will be used. 1-over-5 is a crane that stacks 5 high with one additional row height for passing over containers. The 1-over-5 height is a current industry standard.

The key question of dwell times is usually based on historical data from the port. However, PATH is a new facility in a port that has not handled containers in the past in a region unaccustomed to transshipment. As such, the five following distinct dwell times were considered for PATH:

- Transshipped imports;
- Transshipped exports;
- Local imports;
- Local exports; and,
- Empties.

Based upon a review with PAPA of historical dwell times from Port Metro Vancouver, the following dwell times were adopted:

• Transshipped imports	3.5 days
• Transshipped exports	6.0 days
• Local imports	3.0 days
• Local exports	5.0 days
• Empties	10.0 days

In addition to these dwell times, the percentages of imports vs. exports, empties vs. ladens, etc. as outlined in the planning criteria are used to determine an overall laden dwell time and are mostly based on typical PNW traffic.

Empty slots are required to allow for congestion free and efficient movement of containers within the CY in addition to any empty slots required for RMG or ASC digging. The operating efficiency factor is the average percentage of slots that can occupied throughout the year. For a manned top-pick or RTG operation this value generally ranges between 55% and 75%. Since PATH will be automated higher densities can be achieved since the yard planning is more controlled and the ASCs, when not required for stacking or retrieval, will continuously sort. As a result an industry accepted density of 85% is adopted for the CY.

A seasonal peaking factor is introduced to ensure that the CY is large enough to handle the seasonal peaks in traffic. The factor can simply be the volume from the busiest month divided by the average monthly volume. This typically ranges from 10% to 30%. A value of 20% is adopted for PATH based on past data from Port Metro Vancouver.

Based on all these factors and others listed in the planning criteria the simulation estimated that 12,000 TGS are needed to handle the annual throughput.

Once the amount of space has been determined then the number of ASCs needed to meet demand from the berth and truck handling areas is necessary. At peak there could be 14 QCs discharging or loading vessels at the primary berths, 6 QCs working at the feeder berths and 200,000 to 500,000 TEUs being handled during daytime hours at the truck area. The 14 QCs at the primary berth, if all working, will generate 504 moves per hour while the 6 QCs at the feeder berths can generate 204 moves per hour. Based upon dynamic simulations at other proposed automated facilities with parallel stack orientation, the ASCs should be able to average about 22 moves per hour. As a result, and allowing for 10% additional equipment down for maintenance, 36 ASCs will be needed in the CY to handle the berth traffic.

To serve the 200,000 TEUs of local traffic the CY ASCs will need to support the truck area RMGs. At 200,000 TEUs on average about 400 trucks per day will need to be serviced and at peak 58 lifts per hour may be required. At 22 moves per hour an additional 3 ASCs in the CY are needed. If the gate is handling 500,000 TEUs per annum 7 ASCs are needed but about 5 less to work the berth so in total it is estimated that 40 ASCs are needed in the CY. This value will need to be confirmed at a later date though dynamic simulation.

In addition to ASCs (or AutoRMGs) the number of AGVs needed to handle the horizontal transport between the primary berths, feeder berths, truck area and the CY is required. This determination requires dynamic simulation of the facility which is well beyond the scope of this report. However, to estimate a rough figure the average distance of travel of the AGVs serving the primary berths and feeder berths was estimated. The terminal plans described in subsequent sections were used. Then based on an average speed of 2.75 m/s, expected durations for loading and discharge plus 10% for equipment down for maintenance the number of AGVs was calculated. The number estimated on this basis is 136 AGVs. This value must eventually be reviewed in detail through dynamic simulation.

3.6 TRUCK OPERATIONS

As has been noted previously, a dedicated truck loading area is needed to handle the local traffic. This area will consist of a separate fleet of custom-built cantilevered RMGs that can on one side interface with AGVs and on the other side with trucks that back into lanes beneath the RMGs. In addition, truck gates are needed to process inbound and outbound trucks. For PATH the truck area and gates are sized for 500,000 TEUs per annum. This volume is expected to generate roughly 900 to 950 trucks per day with hourly peaks of 169 trucks.

Based upon discussions with PAPA it is expected that the dedicated RMGs that will transfer containers between truck and AGV can load or discharge 25 trucks per hour. Therefore at peak hours about 8 RMGs will be needed. The AGVs used to serve the truck area are expected to be a dedicated fleet of Lift AGVs. This type of AGV has a lift mechanism built into the deck as seen in Figure 6 below. When the AGV arrives at the truck area it can lift and place the container onto a temporary storage rack. By doing so, the AGV is not required to wait for the RMGs to pick up the container or deliver it. This will reduce the number of AGVs needed. It is expected that at the start up volume of 200,000 TEUs per annum 8 Lift AGVs will be required. As the 200,000 TEUs of local volume grows to 500,000 TEUs per annum, regular AGVs serving the berths will be converted to serve the truck area as less will be needed to serve the reduced feeder vessel traffic.

Figure 3-6 Lift AGV with Two Twenty-Foot Containers (Left) and Containers Deposited onto Storage Racks (Right)

For planning the truck gates the number of lanes and queuing length required for each lane depends on the expected volume of trucks, the gate hours and the time it takes to process each truck. At 200,000 TEUs per annum the average number of trucks per day is about 375 while at 500,000 TEUs per annum this will grow to about 950 trucks per day. It is expected that an advanced clerkless, Optical Character Recognition (OCR) equipped gate system will be implemented.

This gate system involves an OCR pre-gate, in-gate with remote clerk interface and OCR out-gate. The first stage (pre-gate) will include data collection by OCR including driver, container, and truck ID plus line scan photo record of container to record its condition and if desired weighing at an unmanned station. In addition, the reservation is confirmed if a reservation system is included into the gate system.

The second stage (receiving gate) includes data verification and equipment inspection using intercoms and cameras that are remotely manned with clerks. If there is an issue with the information, the driver would pull into a trouble resolution area to resolve these issues separately. Once everything is in order, the driver receives yard locations by means of a printed ticket and enters the terminal to await pick-up or delivery of a container.

The out-gate process again involves data collection by OCR to confirm the outgoing truck contains the correct container. Once a match is confirmed the truck will be allowed to exit with no interaction with a clerk.

Using the expected truck volumes, gates hours of 07h00 to 16h00 and the gate process times listed in the planning criteria the truck gates will require the following minimum infrastructure to achieve the listed throughput:

200,000 TEUs per annum

- 2 OCR Pre-Gate lanes;
- 3 In-Gate lanes 120 m long for queuing; and,

- 2 OCR Out-Gates lanes 110 m long for queuing.

500,000 TEUs per annum

- 2 OCR Pre-Gate lanes;
- 6 In-Gate lanes 150 m long for queuing; and,
- 3 OCR Out-Gate lanes 180 m for queuing.

3.7 ANCILLARY FACILITIES

In addition to the five major terminal components; primary berths, feeder berths, CY, truck interchange area and truck gate the terminal requires a number of ancillary facilities that support container operations. These primarily include:

- A maintenance and repair (M&R) facility including building and space for maintenance personnel parking;
- Electrical substations;
- An administration, planners, remote operators, and clerk office building;
- Meal and restroom buildings for berth operations;
- Parking for terminal staff;
- Regular fuelling facility; and,
- AGV fuelling stations and/or battery exchange facilities for Battery AGVs.

The AGVs are available in two drivetrain options, either diesel electric or battery operated. If diesel electric is chosen, a facility for automatic fuelling is required. If battery operated is preferred, a battery exchange building where an AGV can exchange for new batteries and depleted batteries are recharged as needed.

At the very least the maintenance facilities, fuelling facilities, and battery exchange buildings should be located directly adjacent the terminal CY for ease of access by AGVs.

The M&R facility/building would house mainly AGV and spreader repair bays plus a wash bay and welding shop. A parts room and offices for berth operations labour shift, foremen, supervisors and maintenance staff is also required. The M&R building is expected to have roughly 12 AGV bays, 6 spreader bays and thus be in the order of 3,900 m^2 in size.

The administration building would hold offices for senior staff, planners, remote operators, clerks, IT, etc. and would be much larger than for a conventional terminal. It is expected it will be in the order of 3,700 m^2.

3.8 TERMINAL LAYOUT AND REFINEMENT

With the results of the simulations and planning exercise described above, terminal layout options A and B (as detailed in Section 2.3) were further refined and developed for the selected sites. Three plans in total have been developed; one for the north site and two for the south site. These plans are enclosed in Appendix C and include the drawings below:

TABLE 3-1 CONCEPT LAYOUT DRAWINGS – SARITA BAY

Drawing Number	Rev	Description
329510-PO-100-S0-0001	B	Sarita Bay South Site – Alternative General Arrangement
329510-PO-100-S0-0002	C	Sarita Bay North Site – General Arrangement
329510-PO-100-S0-0005	B	Sarita Bay South Site – General Arrangement

With the exception of the overall terminal shape, the three proposed plans are all very similar in nature and have the same basic components as follows:

- The primary berths are at a minimum 1,000 m long to accommodate two 22,000 TEU vessels simultaneously. These vessels have an LOA of 460 m each. A bow to stern separation of 37.5 m is provided along with a minimum length of 21.25 m between the stern or bow and end of wharf for access to the outer vessel container rows.
- Each plan has two feeder berths; one berth either end of the primary berths. Each feeder berth will be minimum 232.5 m long to accommodate one 1,200 TEU barge (LOA of 97 m) or one 600 TEU barge (LOA of 97 m) and one 300 TEU barge (LOA of 73 m). Feeder ships up to 145 m in length can also be accommodated.
- Between the waterside crane rail and berth face a setback distance of 6.5 m is provided for vessel access and protection of the QC legs.
- All QCs are expected to have a rail gauge of 30.48 m (100 ft). Within this portal distance, hatches can be stowed and labour provided access to the QCs. This will be a manned area.
- Each primary berth will have 7 QCs while each feeder berth will have 3 QCs for a total of 20 QCs.
- Marine operations buildings will be located at the outer ends of the primary berths.
- As a result of the above dimensional requirements (vessels, equipment, etc.) and to ensure AGV access to the full QC backreach width and personnel access to the berth apron, wharf lengths have been adjusted as seen on each plan. The result is wharf lengths longer than the minimums noted above.
- The berth apron behind the backside crane rail has a width of 80 m to the first stack of containers to provide sufficient maneuvering area for the AGVs.
- Each CY has approximately 12,000 TGS in 12-wide container stacks orientated parallel to the primary berths. The stack length is no more than one berth length, i.e. about 500 m. The CY will be served by 40 1-over-5 ASCs that have a cantilever at one end where containers are delivered or received from the AGVs. The cantilever ensures that AGVs do not cross ASC crane rails.

- At the backside of the CY a truck interchange area is provided near mid terminal. The truck interchange will consist of roughly 40 Lift AGV racks slots for pick-up and delivery of containers to the area by Lift AGVs. A total of 8 RMGs that will handle containers longitudinally interchanging containers between the rack area and opposite truck lanes. A small container buffer will be provided between the rack area and truck lanes. Truck will back into the lanes for receipt and delivery of containers.
- The truck interchange area will be connected to a nearby truck gate complex that will include the OCR pre-gate, in-gate and OCR out-gate as described earlier in Section 3.6.
- In addition to the truck interchange area and truck gates at the backside of the terminal will be located the administration building, and electrical substations.
- A long linear maintenance building will also be located at the backside of the terminal adjacent an AGV route so AGVs have direct access to their M&R bays. Connected to the bays will be the maintenance offices, parts rooms, personnel lockers and other facilities as detailed in Section 3.7.
- Privately Owned Vehicle (POV) parking at the administration and M&R buildings.
- Two battery exchange buildings are provided; one at each end of the terminal.
- Fencing will be provided along the terminal boundary for security while fencing will also delineate the automated area for security and safety.
- High-mast lighting lines the perimeter of the automated terminal and non-automated areas.

Beyond the key components noted above which are essentially the same at each terminal plan, the variations of each plan reflect modifications made to the two original concept layouts to accommodate the topography and bathymetry of each site. These layouts are the result of iterating configuration of the generic concepts described in Section 2.3 to minimize earthwork and dredging quantities, while also providing a form of road access to the site.

Appendix D includes drawing 329510-MH-100-S0-0001 which has the overall flow diagram for the facility.

4 TERMINAL INFRASTRUCTURE

4.1 OVERVIEW

Following short listing of the sites to Sarita Bay and refinement of the generic concept layouts to accommodate each location's site conditions, terminal layouts at Sarita Bay North and Sarita Bay South were progressed to a pre-feasibility design level to determine Order-of-Magnitude cost estimates. An aerial photo showing the two Sarita Bay sites is shown in Figure 4-1 below.

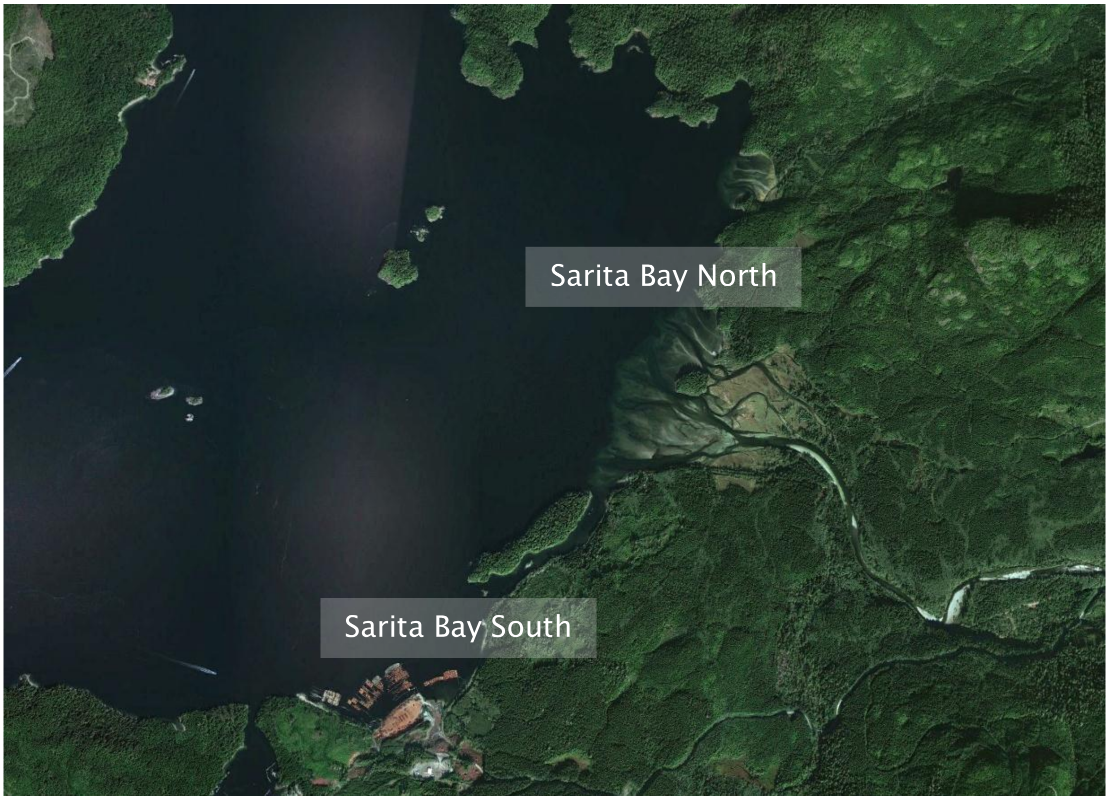


FIGURE 4-1 SARITA BAY AREA (GOOGLE EARTH, 2010)

A design criteria was developed (refer to Appendix E) that set out standards and limits by which the design would follow. These criteria are also recommended for use as the project progresses through future phases.

The following sections outline the key basis of design and outcomes. A range of pre-feasibility design drawings are included in Appendix F.

4.2 MASS EXCAVATION AND FILL

Throughout the Alberni Inlet the coastline is steep and rocky with a dense covering of trees. The two sites chosen at Sarita Bay reflect the largest areas of relatively gentle terrain available of the key sites originally identified for consideration.

3D geographic models were developed to estimate the mass excavation and fill required for each site option. The subgrade level was determined as 1 m below finished grade and the models were developed accordingly. At the berth face and berth pockets, the sub grade level was determined as the level immediately beneath the various bedding and structural fill levels, defined further in Section 4.3.

As no geotechnical information was available at this stage for the ground conditions along the Alberni Inlet, HMM assumed for conservativeness that steep valley sides consist predominantly of hard rock. As such, cut slopes were designed at a conservative 70 degrees. This angle allows for 10 m high, 1 m deep slope stability benching.

Excavation of rock would likely involve excessive blasting. The opportunity associated with this is that there is the potential for re-use of this rock as backfill by crushing and grading the material on-site into the different sieve gradations. Further investigation into the ground conditions will be required in future phases to confirm this assumption.

The following sections briefly outline description of the layouts chosen for each site.

4.2.1 Sarita Bay South

Drawing 329510-PO-100-S0-0001 shows a terminal layout resembling option A that moves the primary berth seaward. This allows for the feeder berths at each end to be turned perpendicular to the primary berths taking advantage of the available water depth. With the feeder berths located to the sides of the CY, the stacks are orientated in 8 symmetric rows behind and at the width of the primary berths. This layout provides for a compact, symmetrical and efficient facility.

The other option for Sarita Bay South is shown on drawing 329510-PO-100-S0-0005 which is premised on creating a shallower terminal based on option B to avoid larger topographic peaks inland of tidewater. The west feeder berth is orientated perpendicular to the primary berths, while the east feeder berth is in line with the primary berths as insufficient water depth exists to turn the berths perpendicular unless extensive dredging is undertaken. To make the terminal shallower three of the CY stacks are moved from the back of the terminal to the sides of the primary berths, primarily behind the east feeder berth.

Both options make use of the long but narrow Santa Maria Island to minimize the earthwork quantities.

4.2.2 Sarita Bay North

At Sarita Bay North, a shallower linear terminal based on option B is deemed more suitable because bathymetric contours are more linear so turning the feeder berths would require extensive dredging and a shallower facility avoids high topographic features to the east of the facility. The shallower facility also enables the use of the flat marshy area at the Sarita River delta to further minimize earthwork. The result, as shown on drawing 329510-PO-100-S0-0002 is a wide, shallow facility in which 4 long rows of CY stacks are provided the full width of the facility, plus two additional rows behind the primary berths. This facility perhaps provides the greatest flexibility and efficiency with one long wharf face and shallow CY areas behind each primary and feeder berth.

4.2.3 Earthwork Quantities

Based on the description and assumptions outlined above, the mass excavation (on-land and excavation) and fill quantities for the layouts investigated are shown in Table 4-1 below.

TABLE 4-1 EARTHWORK QUANTITIES – SARITA BAY

		Total Volumes, m^3			
Site Name	Site Area, m^2	Fill	Cut (on-land)	Cut (dredging)	Net Volume, m^3
Sarita Bay South	789,400	1,624,000	13,025,000	975,000	12,376,000
Sarita Bay South - Alternative	782,200	3,750,000	6,989,000	291,000	3,530,000
Sarita Bay North	814,900	2,180,500	8,607,000	1,315,000	7,741,000

4.3 VESSEL BERTHS

Typically marine structures that provide a berth for calling vessels consist of either piled foundations with supported spans or gravity based structures, such as bulkhead wall or caissons. The suitability of the foundation type is highly dependent on the site's geotechnical soil conditions. Although no geotechnical investigations have been undertaken, by surface observation it appears the underlying geology at the PATH sites are likely to be rock. The following provides a brief description of the construction of these foundations.

4.3.1 Wharf Structures

A typical continuous piled wharf consists of steel pipe or precast concrete piles supporting concrete pile caps and concrete deck. If shallow rock is encountered the piles would be placed in holes drilled into the rock and then socketed (pin piles or steel rebar cages concreted into the seabed) to provide the required connection capacity. The concrete pile caps will be formed on the top of the piles in order to create a deck support structure on which to support the deck spans. The installation of socketed piles can be costly and time consuming.

Alternatively, a more cost-effective solution in shallow rock may be to use a gravity based structure such as a caisson. This type of structure is very common at container terminals across Canada and has been chosen for PATH. Future studies are warranted to provide a comparison evaluation of wharf types.

Some advantages of caisson wharves over piled wharves include:

- Prefabrication can be completed offsite;
- Shorter installation time (less time onsite);
- Rugged structure;
- Generally can support a high surcharge (live load); and,

- Ideal for continuous cranes;

The following sections describe the construction and installation of a caisson wharf.

4.3.1.1 Caisson Wharf

Concrete caissons can be used to construct a continuous wharf, provided that conditions make installation of caissons feasible. Caissons are gravity structures and can be prefabricated offsite in a dry dock facility (see Figure 4-2) or on a barge and either towed to site or transported on submersible vessels.

FIGURE 4-2 CONCRETE CAISSON IN A DRY DOCK

Almost every container terminal wharf in Canada are constructed from concrete caissons, while in the United States pile and deck construction is preferred. In British Columbia, all of the caissons (Vanterm, Centerm, Deltaport, and Fairview terminals) were constructed in the Vancouver Pile Driving's graving dock in North Vancouver. However, the available dimensions of Vancouver Pile Driving's graving dock limits the size of the caissons. This will be an issue for PATH as the caissons required for the wharf are expected to be larger than any previous construction due to desired water depths. The caissons would most likely be cast in a purpose-built graving dock near the project site, or possibly at the Public Works and Government Services dry dock in Victoria. The caissons would then be towed to the site at Port Alberni. As a general rule of thumb, an underkeel clearance (UKC) of 15% of the largest vessel's deepest draft should be provided at the wharf. This is used to determine depth of water required at the berth and hence, a key factor in the size of the caissons.

Caissons are designed to be buoyant, floated into position and ballasted on to a prepared foundation bed or mattress made of select gravel (see Figure 4-3). The foundation is placed after drilling and blasting higher elevations of rock, dredging of the seabed to ensure a level area and placement of suitable fills to raise the seabed if necessary. The gravel bed foundation ensures stability of the structure and must be designed to withstand the bearing pressures from the caissons and scour from vessel propellers.

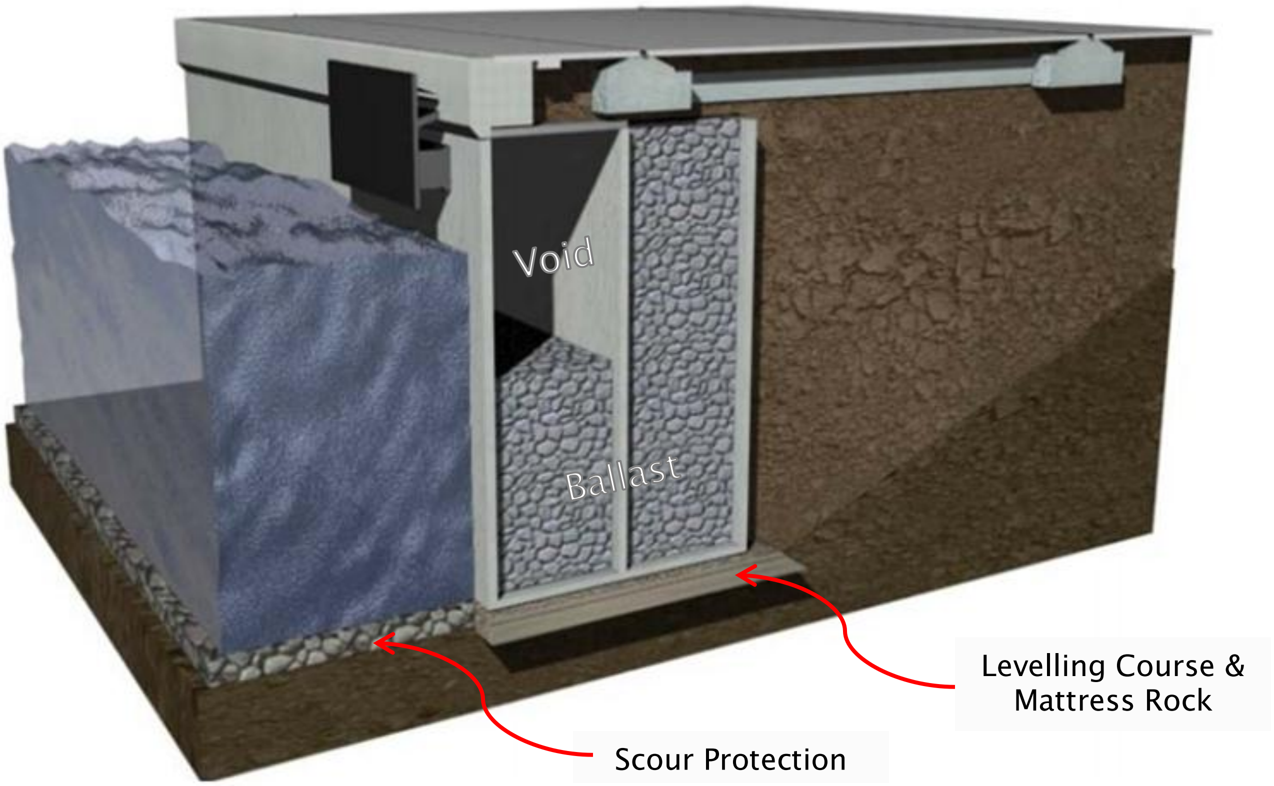


FIGURE 4-3 TYPICAL CAISSON – SECTION VIEW

During installation (Figure 4-4), individual caissons are lowered by opening flood valves to allow the unit to sink at a controlled rate. Caissons can be of relatively light reinforced-concrete construction, since they are not subjected to severe stresses during sinking. Light construction is desirable to give the required freeboard whilst floating.

FIGURE 4-4 CONSTRUCTION OF A CONCRETE CAISSON WHARF AT DELTAPORT

After ballasting they can be filled with mass concrete or ballast rock if dead weight is required for the purpose of increasing the resistance to overturning or lateral forces (see Figure 4-5). After the caisson is placed on its gravel bed, additional ballast water may also be pumped in to ensure sufficient mass weight. The final ballast comprises of a combination of rock fill and water.

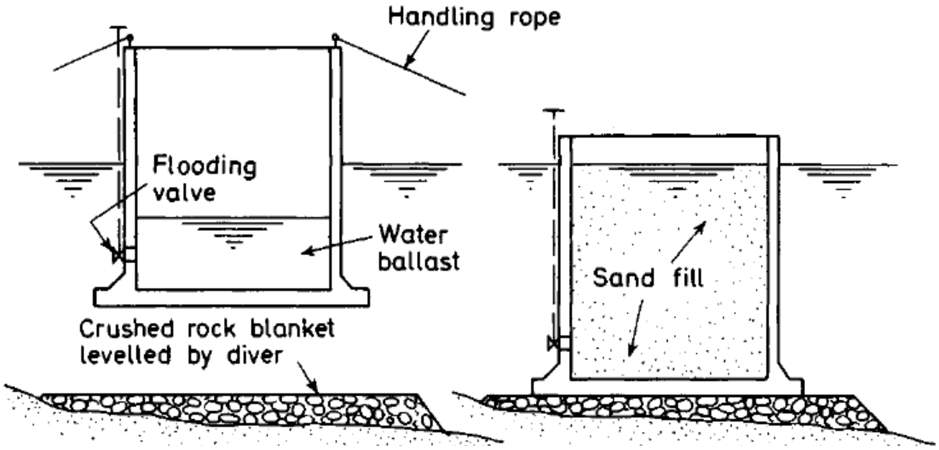


FIGURE 4-5 STAGES OF CAISSON INSTALLATION, SINKING, AND PLACEMENT

4.3.2 Dredging, Excavation and Fill

Extensive blasting and dredging as well as rock fill will be required at the sites for PATH.

Where seabed rock is higher than the caisson base elevation the sequence of work will include:

- Overburden dredging (if required);
- Drilling and blasting; and,
- Blasted rock dredging.

Excavation of overburden materials (to solid rock) can be executed using a clamshell or backhoe dredge (see Figure 4-6). Excavated material will be disposed onto flat top barges for disposal. Depending on the outcome of sediment sampling and depth of overburden, alternate equipment may be selected, for example a trailing suction hopper dredge or a cutter suction dredge.

FIGURE 4-6 BACKHOE DREDGE

Drilling and blasting of solid rock will be completed using a drilling and blasting barge(s). After the rock has been blasted, the dredge(s) will excavate material and place on flat top barges for disposal (see Figure 4-7).

FIGURE 4-7 LOADING DREDGEATE ONTO A FLAT TOP BARGE WITH A BACKHOE DREDGE

In caisson locations where the existing seabed elevation is much lower than the final caisson base elevation the fill from quarries or more likely upland excavations will be placed to build up the foundation area. In some areas, weak seabed materials may need to be replaced with new fills which may require vibro densification.

4.3.3 Keyway and Topside Works

Once the caissons are in place a key-way is required to seal the vertical joints between the caissons. The keyway is a precast concrete slab placed carefully between the waterside faces of the caisson supported by concrete protrusions cast in the caisson.

Topside works may commence once the main caissons are set in place, back filled, ballasted, and keyways placed. The work will include the following:

- Mass cast-in-place concrete cope beam at waterside face;
- Rear crane rail beam, and possible crane beam piles;
- Waterside crane rail beam cast on top of caissons;
- Backfilling to final subgrade elevation;
- Trench drain between waterside crane beam and berth face;
- Ship-to-shore gantry crane power cable pits;
- Ship-to-shore gantry crane service pits;
- Shore power plug-in power pits;
- Crane rails;
- Crane rail stops and crane stowage pin slots;
- Bull rails and curbs;
- Marine fenders;
- Bollards;
- Ladders;
- Navigation lights;
- Wharf services, including water supply, ducts and cabling for power and communications, etc.; and,
- Pavements, including base courses.

As it is anticipated that the waterside crane rail will be set back from the berth face by 6.5 metres, a ship-to-shore cable trench with panzerbelt will not be necessary.

Once complete the wharf will be ready to receive its first container ship.

4.4 UTILITIES AND SERVICES

4.4.1 Site Utilities

Site utilities cover water supply, potable water distribution, rainwater management, sanitary sewers, and fire water distribution. The systems shown in the drawings represent initial concepts to provide potable water to the buildings, collect and manage rainwater on the site, collect and treat human effluent from the buildings, and provide fire water coverage to all parts of the site.

The systems perform the following functions:

- Water supply system pumps water from a nearby water body and treats it;
- Potable water distribution system pumps treated water to the buildings;
- Fire water system pumps untreated natural water up to the fire water tank and distributes it to hydrants and flush connections which are spaced per NFPA requirements for wharves;
- Sanitary sewers collect and direct human waste to a package treatment system which outlets it to a holding pond for release
- Rainwater collects in drain trenches and is pumped to the holding pond for release

The systems shown on the drawings in Appendix F include many coarse assumptions and leave several opportunities for improved performance and reduced capital and life-cycle costs. The assumptions include:

- Stable annual water flow in the chosen source water body;
- Water treatment used only for potable water with fire water kept separate and left untreated;
- Rainwater is not collected for site use;
- Rainwater and sanitary sewer trench depths are limited and pumps used to substitute for gravity flow; and,
- General fire protection requirements for wharves remain the same for an automated container terminal.

Opportunities for improved performance include:

- Consolidating fire and potable water systems to reduce pipe network;
- Resizing the fire water tank to serve as general water tank to reduce pumping requirements;

- Incorporating rainwater capture in the water supply system to reduce infrastructure requirements;

- Incorporating onsite landscaping outside the automated zone to reduce infrastructure requirements; and,

- Constructing an engineered wetland to reduce infrastructure requirements.

4.4.2 Yard Paving

A heavy duty pavement design is incorporated into the CY to accommodate loads from mobile equipment and container stacks. The global elevation of the site will be a constant 8 m above CD with the exception of localized depression for drainage purposes. With this design, containers are expected to stay levelled at all four corners to ensure the effective operation of the ASCs. For drainage purposes, localized trenches have been included along the container stacks in place of overall site grading.

Running along each side of the container stacks are concrete runways to support the ASCs' crane rails. A heavy duty design of the runways has been included to account for the high loads expected of an ASC capable of spanning twelve containers (approximately 2 m wide by 1 m deep).

4.4.3 Site Access Roads

The gravel site access roads were designed using a WB-20 design vehicle. The minimum horizontal curve radius used was 90 m with a minimum sag K value of 12. These site access roads connect to the existing forestry road network in the area. No upgrades to the existing roads have been assumed as part of this study. Further investigation will be required to confirm the condition and suitability for container truck traffic.

4.5 ELECTRICAL

4.5.1 Electrical Power Distribution Systems

A new 138 kV powerline from Port Alberni will provide electrical power to the site. For this design, it is anticipated that this powerline will follow existing roadways and continue along the new access road to the project site. It is assumed that sufficient power is available through BC Hydro to meet the projects demands which were based on preliminary electrical loads. This includes power demand from all electrified equipment (i.e. QCs, AutoRMGs, etc.), vessels connected to shore power, refrigerated containers connected to reefer towers, and the various on-site facilities. Total connected load is estimated at 150 MVA, but through the use of diversity and demand factors, the estimated running power demand is approximately 105 MVA.

An electrical substation will serve as a termination point for the transmission line and also as hub for distributing power within the project site. Drawings 329510-EL-100-S0-0001 and 0002 in Appendix F include a single line diagram which outlines the electrical distribution concept. Duct banks will be installed across the site to facilitate power distribution to all buildings and equipment requiring power.

4.5.2 Shore Power

Shore power connection points will be provided at each berth to allow all ships equipped with shore power technology to shut down their fuel burning engines and utilize shore-side electrical power. This has multiple advantages which include significantly reduced air and noise pollution, and will provide a maintenance window for the ship's engines.

4.5.3 Illumination

Illumination will be provided throughout the site with minimum illumination levels indicated in the design criteria. Reduced lighting will be installed within the fully automated zones to reduce power consumption.

4.6 BUILDINGS AND ANCILLARY FACILITIES

Terminal buildings, with approximate sizes and construction types, are presented in Table 4-2.

TABLE 4-2 BUILDING CONSTRUCTION TYPE SUMMARY

Building	Quantity	Size	Construction
Administration Building	1	3,700 m^2	Two-Story Steel frame
Maintenance & Repair Building	1	3,900 m^2	Steel frame & Masonry
AGV Battery Exchange Buildings	2	400 m^2	Steel frame
Marine Operations Building	2 / 3*	150 m^2	Steel frame
Potable Water Pump House	1	100 m^2	Steel frame
Firewater Pump House	1	100 m^2	Steel frame
Wastewater Treatment	1	100 m^2	Steel frame
Compressor Building	1	100 m^2	Steel frame
Raw Water Intake Shed	1	25 m^2	Steel frame
* - Variation in quantities between options A and B.			

4.6.1 Ancillary Facilities

4.6.1.1 Receiving and Delivery Gates

A 540 m^2 canopy will stretch over the two-lane OCR Pre-Gate. The gate will be equipped with an OCR camera portal system to collect information from the trucks arriving at the terminal. The OCR system will be supported on light steel frames bolted to concrete slabs. The canopy will be of light duty steel frame construction. Concrete slabs will be cast to support the weigh scales if truck scales are incorporated into the OCR Pre-Gate. The rest of the surrounding area, including the lanes leading up to the gate, will be paved with light/medium duty asphalt.

The 900 m^2 canopied in-gate will be designed for the 500,000 TEU scenario (as described in Section 3.6) with 150 m long lanes for trucks to queue at. The canopy will be of steel frame construction akin to the Pre-Gate. Kiosks will be installed for interaction between remote clerks and the truck drivers. The lanes and its surrounding areas will be paved with light/medium duty asphalt.

Similarly, the 1,030 m^2 canopied out-gate will be equipped with an OCR portal system and 180 m long lanes for outgoing trucks to queue at. The lanes and its surrounding areas will be paved with light/medium duty asphalt.

4.6.1.2 Radiation Portal Monitors

Radiation Portal Monitors (RPM) will be installed at a centralized location between the CY stacks and QCs, where it will scan all AGVs carrying unloaded import containers for traces of radiation. The RPMs will span over the four lanes of AGV traffic travelling from the berth backreach area. The units will be installed on a concrete foundation and protected by concrete barriers in the event other mobile equipment colliding with the RPMs.

5 COST ESTIMATE

5.1 SUMMARY

An overview of the project cost estimates at the Sarita Bay sites is summarized in Table 5-1 below.

TABLE 5-1 CAPITAL COST ESTIMATE – SARITA BAY OPTIONS

	Costs	Contingency
Sarita Bay South		
Capital Construction Costs	$1,397,542,990	$185,397,850
Engineering, Permitting, and Procurement	$160,720,000	$32,143,500
Total		**$1,775,800,000**
Sarita Bay South – Alternative		
Capital Construction Costs	$1,718,983,524	$244,649,074
Engineering, Permitting, and Procurement	$197,680,000	$39,536,600
Total		**$2,200,900,000**
Sarita Bay North		
Capital Construction Costs	$1,642,205,118	$239,990,418
Engineering, Permitting, and Procurement	$188,850,000	$37,771,000
Total		**$2,108,900,000**

Refer to Appendix G for the full capital cost estimate and cost breakdown for each site. The latest revision of the cost estimate reflects recent equipment quotes (received April 24 2014) submitted by a major vendor of automated equipment.

5.2 BASIS OF ESTIMATE

The cost estimate prepared for this study is a class 5 estimate as defined by AAEC International. It is based on the following criteria:

- Project definition 2%-10%;
- Expected accuracy -15%/+30%; and,
- Developed for project study.

The cost estimate is prepared in 2014 CDN dollars.

A weighted contingency was allocated to individual costs to reflect the various levels of project definition. The contingency is not intended to cover escalation or project scope growth.

The cost estimate carries a percentage of the total construction cost to account for engineering, construction management, permitting, procurement, and contract administration costs. Being as a preliminary cost review for the first automated transshipment terminal in Canada, the current estimate for the consultant fees is moderately conservative. The cost estimate will be further refined to reflect the accuracy level as the project scope moves into the next level of design. Note that the engineering fee involved would be based on industry standards for a similar sized site with the exception of earthwork and equipment/facilities design. The design effort for the earthworks and to generate technical specifications would be small when compared to their respective construction cost, due in part to the massive excavation requirements and design-build of all major equipment/facilities.

It should be noted that the capital equipment cost does not include costs from commissioning, training, post-commission services, and any additional software and hardware associated to control of the following equipment:

- TOS;
- AGV;
- ASC / AutoRMG; and,
- Clerkless Truck Gate and OCR System.

Escalation and owner’s costs are not included as a part of the cost estimate.

The cost estimate work breakdown structure (WBS) was developed to account for the full scope of the present study, to the level of individual items, and for unit price cost estimating.

The estimating methodology used in developing this cost estimate is unit price cost from HMM’s internal database. Each individual unit price represents the actual cost of construction, inclusive of contractor field costs, mark-ups and fee. No specific contracting/project delivery method was considered.

The quantity take-offs were provided by each engineering discipline, in accordance with the project definition level stated above, and the WBS. The material take-off quantities were developed based on the planning criteria, the location of the terminal, and preliminary engineering design drawings, including:

- Site layouts;
- General arrangements;
- Plans, sections and details; and,
- Standards.

The following sub-sections describe the methods of deriving material take-off quantities for each major category of material.

Marine Structures

The marine structures category includes elements of the wharf structures such as the caissons, crane rails and beams, fenders, bollards, etc. Concrete and reinforcement steel quantities were derived by taking measurements off preliminary design drawings of the wharf structures. Marine structural quantities were benchmarked against other similar projects.

On-shore Structures

The on-shore structures category includes elements required for the RMG rail beams in the container yard, reefer towers, site facilities, etc. Structural steel, concrete, and reinforcement steel quantities were derived from previous projects and scaled to the appropriate magnitude of the PATH project.

Civil

The civil category includes site grading and drainage, service roads, utility services, etc. Earthworks and service road quantities were based on preliminary design drawings. The quantities include bulking factors to account for the expansion and compaction of excavated and backfilled earth. Civil quantities also include security and automated area fencing/gates for each of the options.

Utility service quantities were based on the preliminary design drawings. Piping quantities for water supply, potable, sanitary sewer, storm water, and fire protection water were based on preliminary design general arrangement drawings. The quantified lengths allow for pipe routing across the terminal and to the raw water intake pump station.

Electrical

The electrical category includes substations, terminal lighting, and cables for power and communication distribution. Electrical quantities were derived from the preliminary list of equipment, and were sized and quantified based on preliminary electrical loads. Cable lengths and duct banks were based on material take-off quantities from layout drawings.

Container Handling Equipment

The container handling equipment category includes major equipment such as the ship-to-shore quay cranes, AGVs, ASCs, RMGs, etc. Major equipment quantities were derived from the required terminal throughput and the preliminary layout drawings. Minor equipment such as crew pickup trucks and top-pick handlers were based on the size of crew required to maintain the fleet of equipment. The quantities were benchmarked against similar terminal projects.

6 CONCLUSION

Upon reviewing the preliminary cost estimate presented in Table 5-1, one could quickly draw a conclusion that Sarita Bay South is the ideal location for PATH based on the capital cost alone. However, further investigations and analysis, notably environmental, permitting, and geotechnical assessment of the two sites, would be required to fully identify the benefits and detriments of the two locations at Sarita Bay as a large portion of the engineering is hinged on favourable ground conditions.

Furthermore, the planning effort undertaken to develop the plans in Appendix C and described in Section 3 are very preliminary and conceptual in nature. Although the static simulation techniques used here are considered sufficient for conventional terminal operations which by their very nature have a high degree of flexibility in the event of changing market or operating conditions, facilities where automation is introduced are not as flexible. Automated terminals require precise and detailed analysis to evaluate its operability and feasibility. To do so, dynamic simulation is considered necessary to confirm and prove operating conditions before a final selection of a terminal plan.

In addition to throughput and operating parameters, equipment and capital infrastructure costs, the assessment and comparison of different modes of operation must take into account the long term labour and operating costs over the lease life of the facility to provide a thorough evaluation of the return on investment. Without this, automated facilities will always appear unfavourable since they generally only provide modest throughput gains and have much higher initial equipment and infrastructure costs. It is the labour savings where they show a superior return.

Regardless, some observations can be made from the conceptual work undertaken. The automated terminals appear feasible from an operating perspective. They are balanced and offer flexibility to handle a large volume of transshipment traffic efficiently, particularly with the CY in a parallel orientation and only modest local traffic. In addition, the layouts of the site best utilize the difficult terrain available in the Alberni Inlet and provide designs reflecting minimum earthwork requirements compared to other locations in the Inlet.

At this level, the Port Authority should have sufficient information to request for additional funding for the next phase of design and operational simulation of the terminal.

7 NEXT STEPS

The primary purpose of the conceptual study phase is to identify options for further study in next design phase. The following subsections, broken down into each discipline, detail further investigation required to refine the design and cost estimate.

7.1 SITE PLANNING

- Develop project and construction execution plan
- Dynamic simulation of automated terminal operations
- Confirm permitting requirements

7.2 MARINE STRUCTURES

- Confirm the most suitable wharf type for the site ground conditions
- Further refinement of structural analysis and design (e.g. caisson and rebar design)
- Confirm location of precast concrete plant to produce concrete caissons
- Assess future rise of water levels due to climate change and impact on global site elevation

7.3 ENVIRONMENTAL

- Permitting requirements, Environmental Assessment certifications, and other documents as required
- Investigate compensation and mitigation areas
- Assess wildlife and marine mammal impacts

7.4 CIVIL

Earthworks

- Confirm geotechnical ground conditions at the chosen site for the new terminal with additional testing and analysis

Access Roads

- Investigate condition of access roads and suitability for container truck traffic

Water Source Hydrology

- Confirm water supply suitability and reliability at chosen intake sites (channel capacity, rainfall, water demand)
- Explore Sarita River as water supply source

Fire Water Supply

- Confirm fire protection demand
- Confirm possible fire tank size

Water Supply

- Evaluate pump requirements
- Explore use of raw water tank for overall water supply

Water Distribution System

- Examine opportunities to consolidate raw fire water system with potable water system

Water Management – Stormwater and Black Water

- Confirm drain trench liner requirements and maintenance
- Confirm storm and sanitary sewer line depths and pumping requirements

Power and Communications

- Review power and SCADA requirements for water supply system

7.5 ELECTRICAL

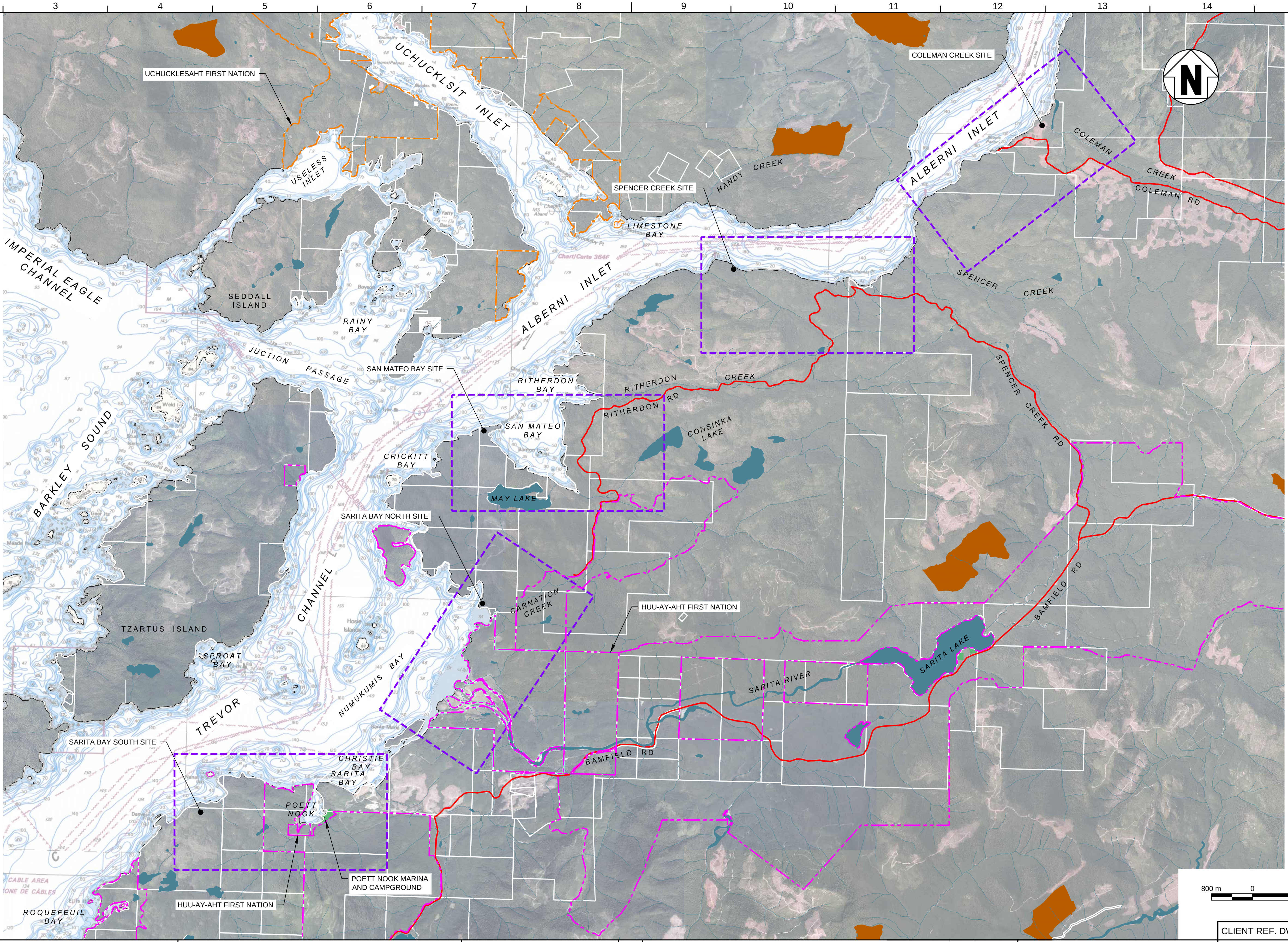
- Further refinement of power demands with vendor-provided equipment loads
- Confirm sufficient power is available through BC Hydro to meet the refined project power demands
- Confirm cabling requirements once the terminal layout is defined
- Evaluate lighting requirements at the terminal once the terminal layout is defined

7.6 COSTS

- Produce a class 3 estimate which has the following attributes:
    - Project definition level of 10% to 40%

  - Estimate accuracy of -10%/+15%
  - Budget pricing for all the major equipment and materials
  - Unit rates confirmed by contractors for the majority of activities
- Completion of contracting strategy
- Completion of schedule, manpower curve, cash flow curve, etc.

Appendix A OPPORTUNITIES AND CONSTRAINTS DRAWINGS



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LEGEND

🟦	LAKE, RIVER, AND CREEK
🟧	UNGULATED WINTER RANGE
🟩	RECREATION AREA
- · - ·	HUU-AY-AHT FIRST NATION TREATY LAND BOUNDARY
- · - ·	UCHUCKLESAHT FIRST NATION TREATY LAND BOUNDARY
——	EXISTING ROAD
- - - -	POTENTIAL SITE AREA
——	CREEK / STREAM

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CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
POTENTIAL SITES
GENERAL ARRANGEMENT

D

PROJECT/DWG No.: 329510-GA-100-S0-0001

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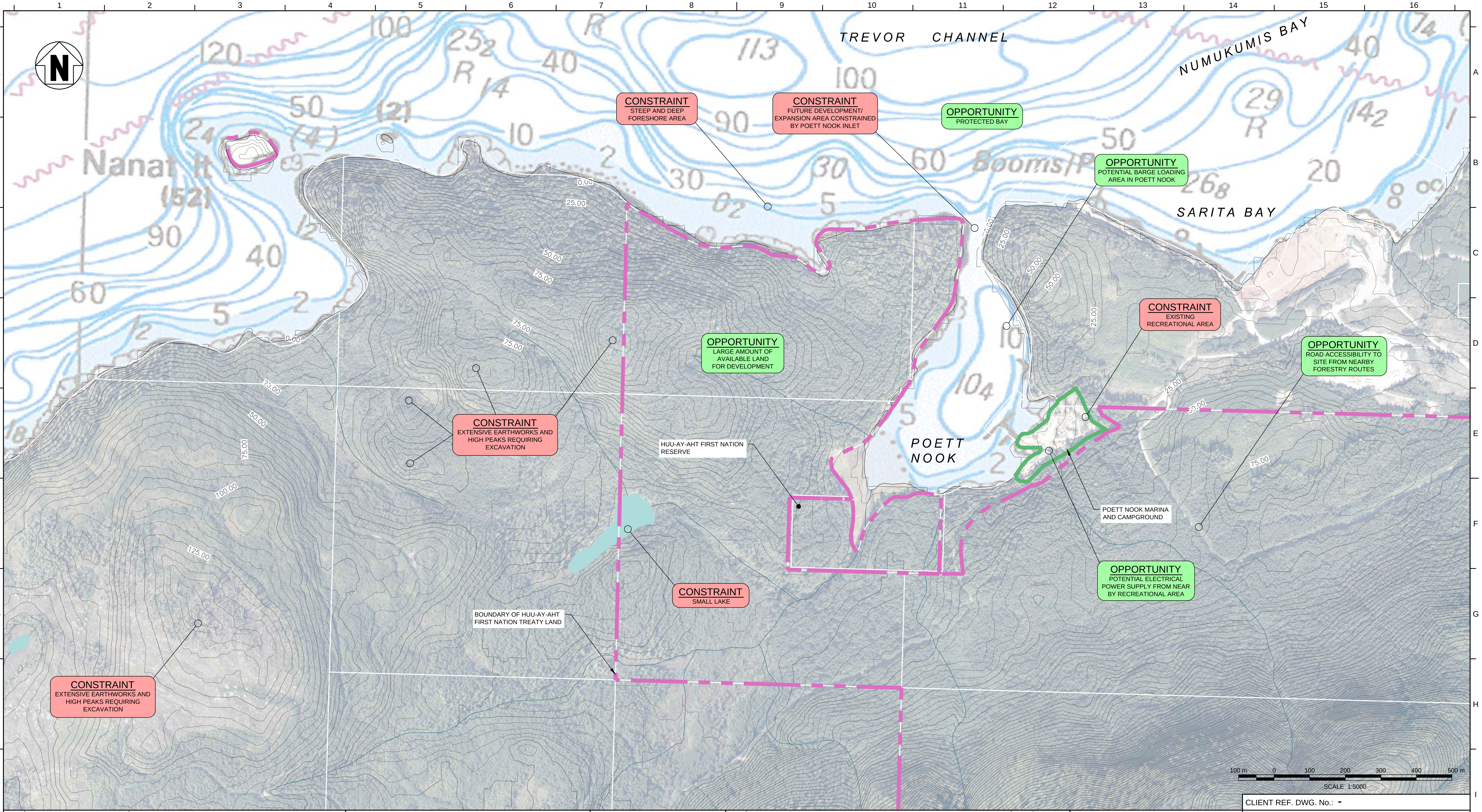

LEGEND

▬ ▪ ▪ ▬	FIRST NATION TREATY LAND BOUNDARY
🟩	EXISTING RECREATIONAL AREA
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PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
OPPORTUNITIES AND CONSTRAINTS

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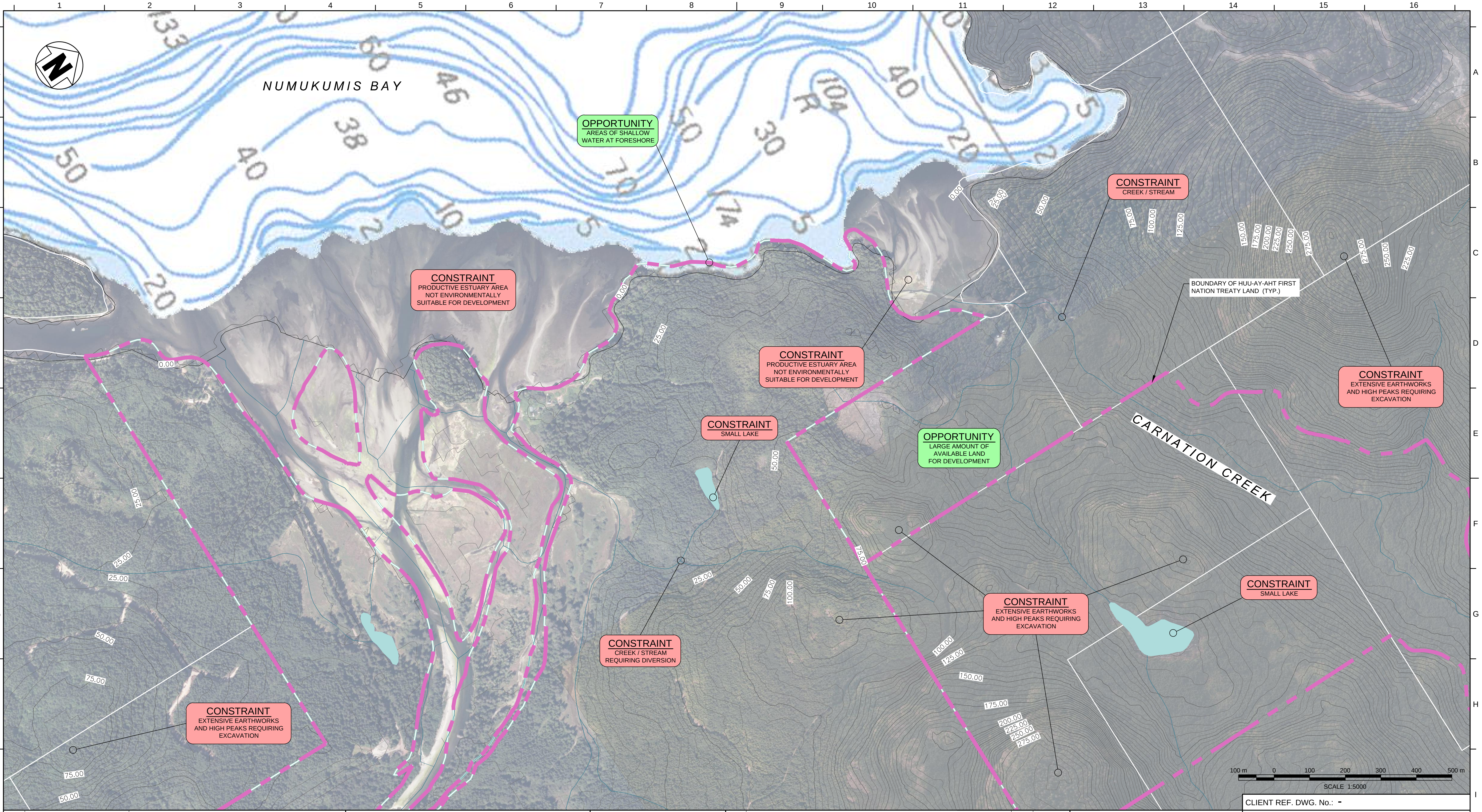

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PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
OPPORTUNITIES AND CONSTRAINTS

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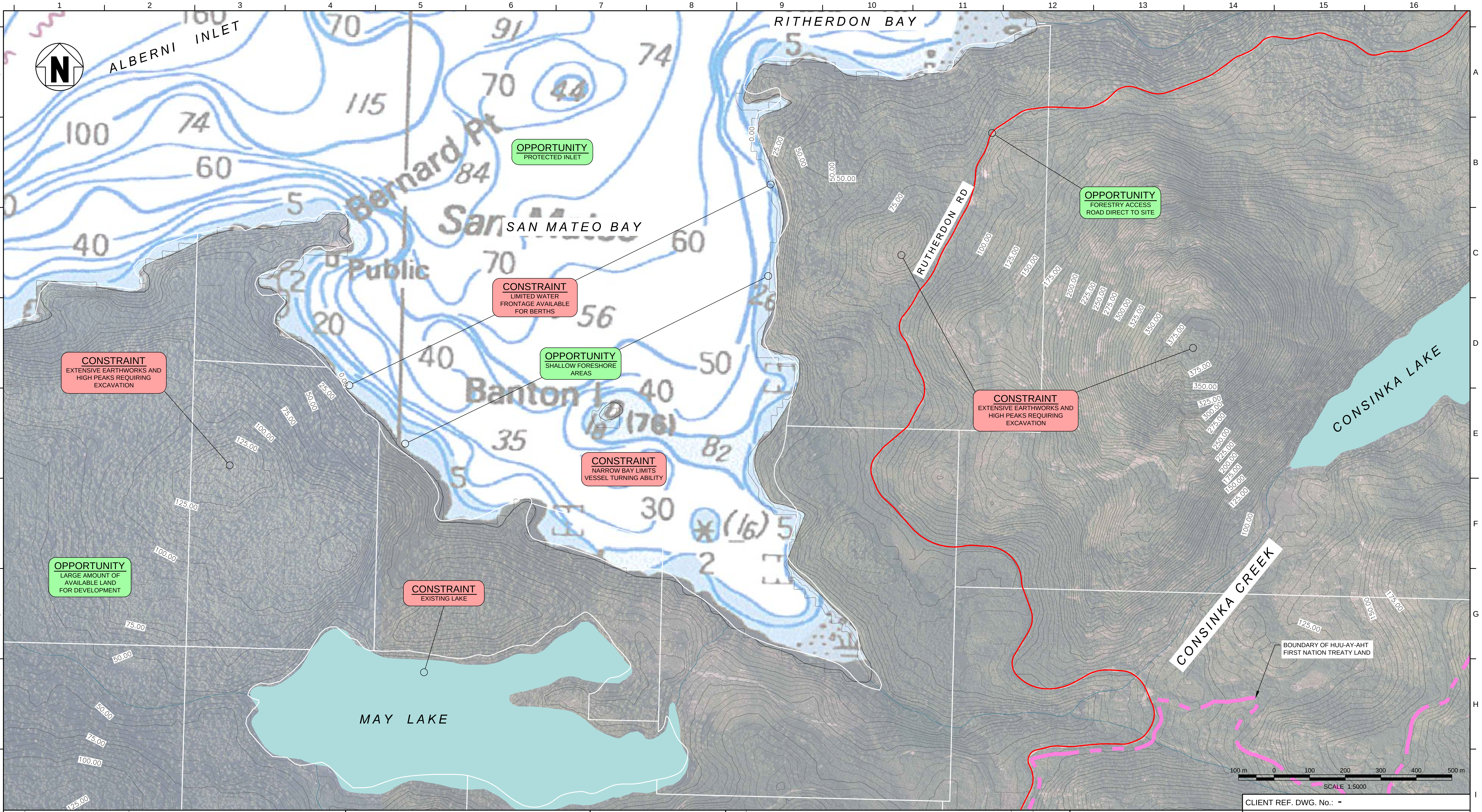

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━	EXISTING ACCESS ROAD
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PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SAN MATEO BAY SITE
OPPORTUNITIES AND CONSTRAINTS

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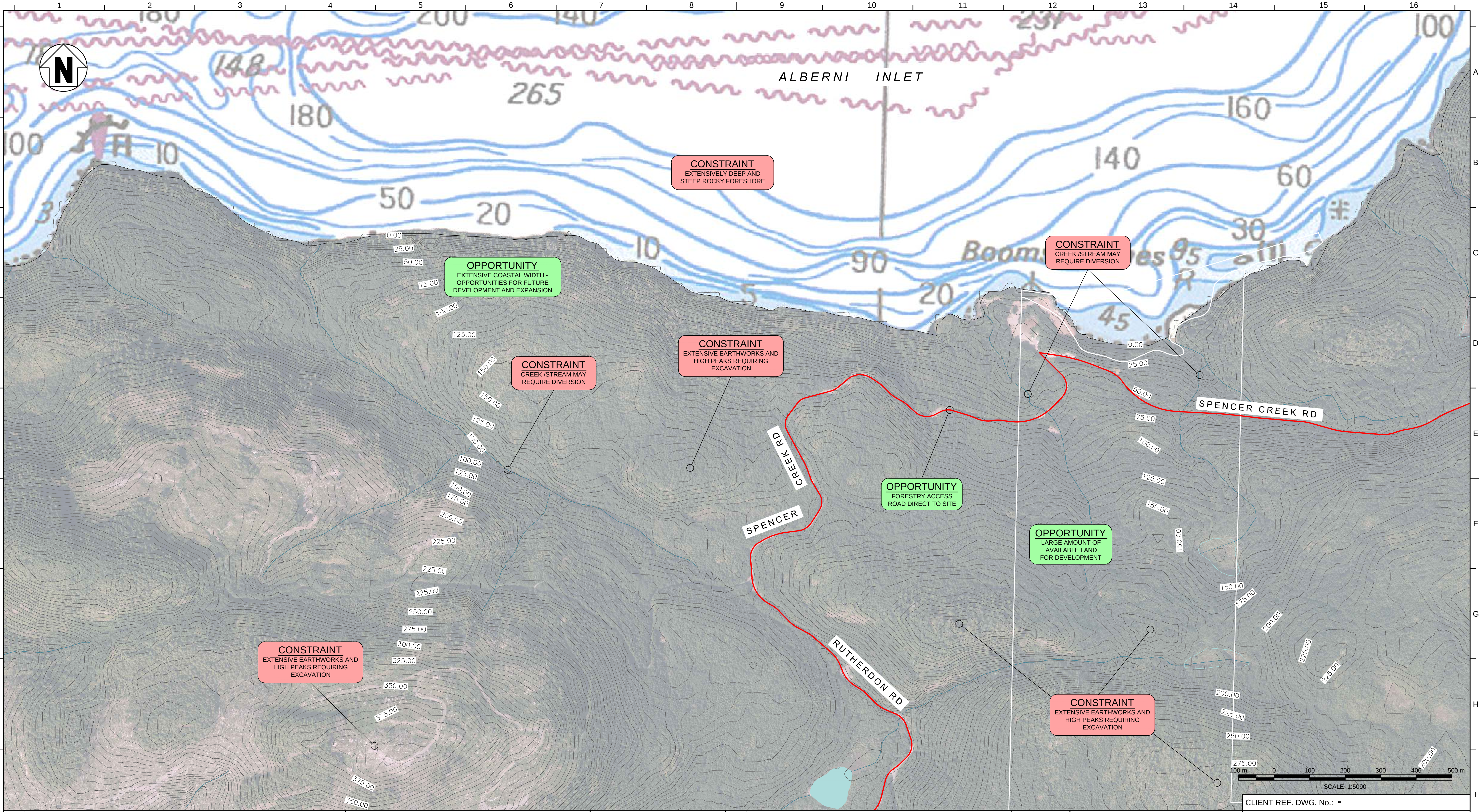

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PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SPENCER CREEK SITE
OPPORTUNITIES AND CONSTRAINTS

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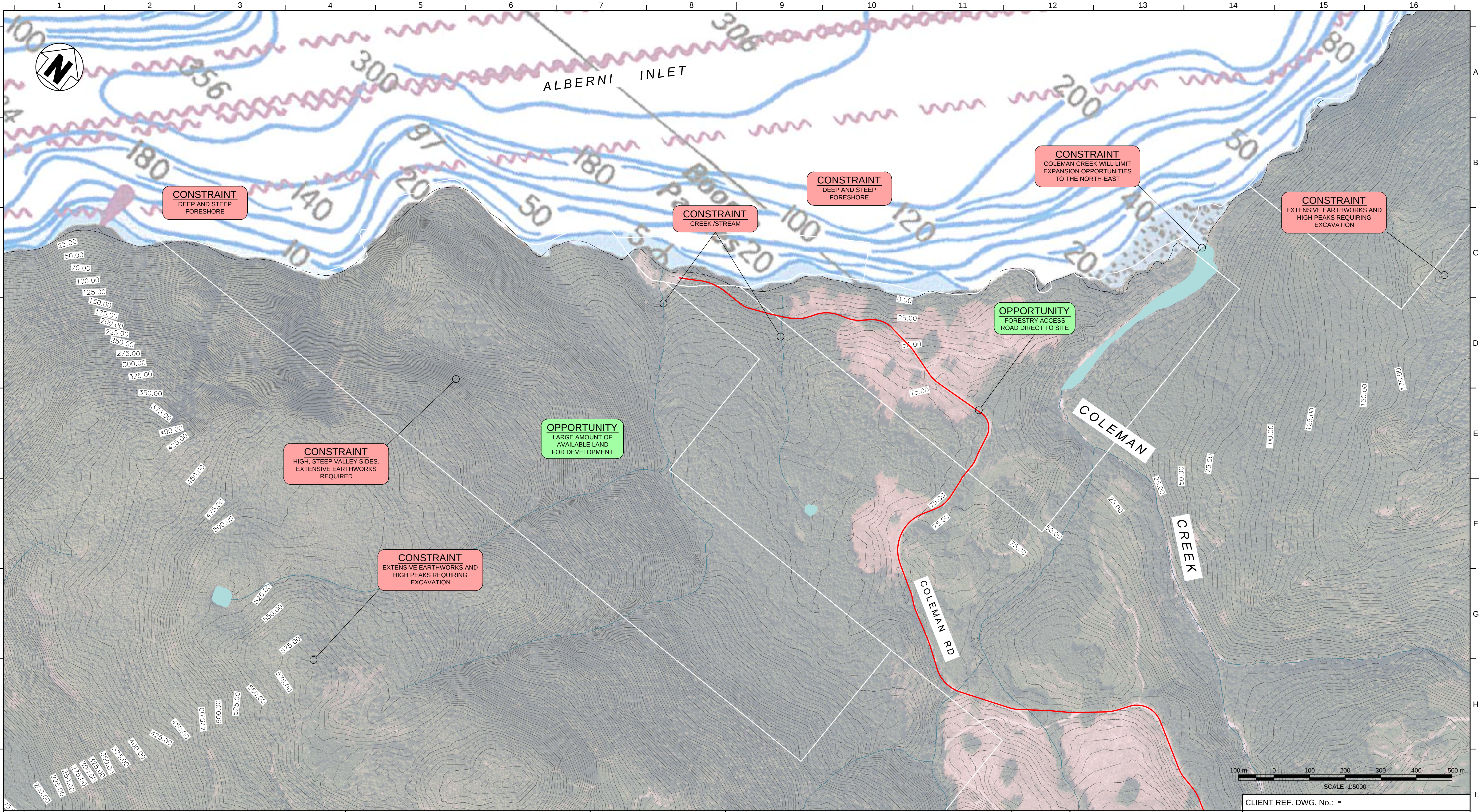

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PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
COLEMAN CREEK SITE
OPPORTUNITIES AND CONSTRAINTS

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PROJECT/DWG No.: 329510-GA-100-S0-0006

REV No A

Appendix B PLANNING CRITERIA

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY

Planning Criteria

Prepared for:

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C	Final	Harold Westerman	Andrew Smitten	Harold Westerman	2014 02 19

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TABLE OF CONTENTS

1 PROJECT DEFINITION

1.1 TITLE OF PROJECT

Port Alberni Transshipment Hub (PATH) Pre-Feasibility Study

1.2 PROJECT DESCRIPTION

The project includes the planning for a minimum two berth container handling facility within Barkley Sound that can handle two 22,000TEU sized vessels simultaneously, with the provision to expand to a further two berths in the future. It is anticipated that every call will require full discharge and load of these trans-pacific vessels.

The majority of all containers discharged will be transshipped to feeder vessels and/or dedicated cellular barges for transshipment to nearby Pacific North-West ports including Vancouver, Seattle, Tacoma and possibly Portland and Prince Rupert. The feeder vessels and transshipment barges may require separate berths for discharge and loading operations.

Horizontal transport between the trans-pacific vessels and the container yard will be by unmanned automated machinery. Horizontal transport between the container yard and feeder vessels and barges may be unmanned.

The facility will also be used to receive and transport local container traffic for Vancouver Island in the region of 200,000TEU/yr. with potential to expand to 500,000TEU/yr. in the future.

Two modes of operation for handling in the container yard will be reviewed including perpendicular and parallel stacking (relative to the berth) using automated RMG's or ASC's. The facility will also include a truck gate for the receipt and delivery of container traffic generated on Vancouver Island. The container transshipment terminal facility plans will include provision for the berths, container yard, truck gates and necessary ancillary facilities including a customs facility, administration and maintenance buildings, fuel facility, etc. The multiple berth terminals may be staged in phases over a set number of years. The phased stages of the facility will allow for the following annual projected throughputs:

- Initial Phase: Two berth terminal with upland facilities to match the berth capacity.
- Future Phase: Four berth terminal with upland facilities to match the berth capacity.

2 TERMINAL PLANNING CRITERIA

2.1 PLANNING CRITERIA FOR BERTHS

The berth alignments and locations shall balance the requirements for upland excavation, dredging and fill at the site, ensure safe navigation to and from the berths from the primary shipping channel, be resistant to environmental and operating loads and minimize environmental impacts.

At the berths the horizontal transport of containers between the ship to shore gantry cranes and container storage yard shall be:

- Automated Shuttle Carriers; or,
- Automated Guided Vehicles (AGVs)

Berth layout and throughput capacity shall also be based upon the following primary factors.

2.1.1 CONTAINER TERMINALS BERTH DIMENSIONS

Trans-Pacific Container Vessels are expected to range between 10,000 TEU to 22,000 TEU vessels):

	10,000 TEU	22,000TEU*
TEU Capacity:	9954	22,000
Max. Vessel LOA:	350.1	460.0
Max. Vessel Beam:	48.2	60.0
Max. Vessel Loaded Draft:	15	16.0
Max. Vessel DWT:	124,479	210,000
Required Water Depth @ 0.0 CD:	17.6	18.7

** Data sourced from industry expectations and/or extrapolated from World Fleet Registry*

Feeder Ships

	1,000 TEU	2,500TEU
TEU Capacity:	1000	2500
Max. Vessel LOA:	164.0	226.5
Max. Vessel Beam:	25.0	32.3
Max. Vessel Loaded Draft:	9.8	12.0
Max. Vessel DWT:	20,156	41,830
Required Water Depth @ 0.0 CD:	11.6	14.1

Cellular Barges

	300 TEU	600 TEU	1,200TEU
• TEU Capacity:	300	600	1200
• Max. Vessel LOA:	73.0	97.0	145.0
• Max. Vessel Beam:	23.0	26.0	32.0
• Max. Vessel Loaded Draft:	5.5	6.0	7.0
• 3-Required Water Depth @ 0.0 CD:	6.6	7.2	8.4

NUMBER OF CRANES PER BERTH

Primary Berths

- 7 or 8 cranes per berth.
- Cranes shall be double trolley, 85 t capacity, 30.48 m (100’) gauge.
- Berth productivity shall be in the range of 6,000 moves per 24 hours

Feeder Berths

- 2 to 4 cranes per berth
- Cranes shall be double trolley, 65 t capacity, 30.48 m (100’) gauge

2.1.2 GROSS CRANE RATE

Total productive container lifts by the ship to shore cranes from the start of the first lift to the end of the last lift, including breaks and downtimes.

Primary Berths

- Gross Crane Rate Double Trolley Cranes: 36 moves per hour

Feeder Berths

- Gross Crane Rate Double Trolley Cranes: 34 moves per hour

2.1.3 SEASONAL PEAKING FACTOR

Factor to account for seasonal fluctuations in terminal throughput.

- Seasonal Peaking Factor: 1.10

2.1.4 BERTH OCCUPANCY

Target percentage of time that the berth is physically occupied by a vessel to ensure a berth is available to a vessel upon arrival and avoids the need to anchor.

Berth occupancy:

- Trans-Pacific Traffic on Primary Berths: 45%
- Feeder Traffic on Primary Berths: 20%
- Feeder Berths: 60%

2.1.5 NET CRANE PERCENTAGE TO GROSS WORKING HOURS

The average amount of time each crane at berth will work the vessel as a percentage of the gross vessel working time.

- Net Crane Percentage: 90%

2.1.6 NET VESSEL WORKING TIME

The percentage of time while the vessel is at berth that it can be worked. Accounts for time to handle lines, final lashing, etc.

- Net vessel working time: 95%

2.2 PLANNING CRITERIA FOR CONTAINER YARD

Two modes of operation shall be examined for the container storage yard. These are:

- Automated RMG or ASC cranes, aligned perpendicular to the primary berths, with 1 over 5 stacking, 8 to 12 wide blocks.
- Automated RMG or ASC cranes, aligned parallel to the primary berths, with 1 over 5 stacking, 6 to 12 wide blocks.

The following primary operating and market criteria shall be used to further determine the container yard layout and throughput capacity.

2.2.1 OPERATING EFFICIENCY

The operating efficiency is the average percentage of time container storage slots are occupied on a peak month.

- Automated RMG or ASC Operating Efficiency: 85%

2.2.2 RMG AND ASC LIFT RATE

- Automated Perpendicular RMG or ASC: Average 15 lifts per hour
- Automated Parallel RMG or ASC: Average 22 lifts per hour

- RMGs Loading Trucks: Average 24 lifts per hour
- Top-picks Loading Trucks: Average 24 lifts per hour

2.2.3 DWELL TIME

Dwell time, expressed in days, is the average time that containers remain in the container yard. This includes the time from when the containers are initially stacked to the time that they are taken out for transport.

- Import Transshipment 3.5 days
- Export Transshipment 6.0 days
- Local Import: 3.0 days
- Local Export: 5.0 days
- Empty Storage: 10.0 days

2.2.4 PERCENTAGES OF THROUGHPUT

The percentage of total container berth throughput split between transshipment and local (Vancouver Island) traffic:

Will be based on the capacity of the primary berths with 7 or 8 ship-to-shore cranes per berth and the following local volumes:

- 200,000TEU per annum in Phase 1
- 500,000TEU per annum in Phase 2

2.2.5 SEASONAL PEAKING FACTOR

The seasonal peaking factor is used to ensure that the container yard is adequate in size to accommodate seasonal fluctuations and peaks in traffic. Factor is volume from busiest month ÷ average monthly volume.

- Seasonal Peaking Factor: 1.20

2.2.6 PERCENTAGES OF RAIL IMPORT/EXPORT AND PERCENTAGES OF TRUCK IMPORT/EXPORT

The total import/export split for transshipped and local expressed as a percentage.

- % of Total Transshipped is Import: 50%
- % of Total Transshipped is Export: 50%
- % of Total Truck is Import: 50%
- % of Total Truck is Export: 50%

The laden import/export split for transshipped and truck expressed as a percentage.

% of Laden Transshipped is Import:	50%
% of Laden Transshipped is Export:	50%
% of Laden Truck is Import:	50%
% of Laden Truck is Export:	50%

2.2.7 PERCENTAGE OF TEU FOR REPOSITIONED DEPOT EMPTIES

Repositioned depot empties are empty containers that enter and leave the terminal though the intermodal yard or truck gate but never cross the berth expressed as a percentage of total berth throughput.

- % Re-positioned Depot Empties: 1%

2.3 PLANNING CRITERIA FOR TRUCK GATE

The truck gates shall use a single stage remote clerk in-gate with no pre-gate and the out-gate shall also use optical character recognition. The following criteria are used to determine the truck gate layout and throughput capacity.

2.3.1 PERCENTAGE OF TERMINAL THROUGHPUT MOVED BY TRUCK

Will be a function of the primary berth capacity for trans-pacific volume and the following:

- 200,000TEU per annum in Phase 1
- 500,000TEU per annum in Phase 2

2.3.2 GATE PROCESSING RATE: INGATE/OUTGATE

The gate processing rate, expressed in minutes per truck, is the rate for a single gate lane to process one truck. In-gate processing includes assignments, inspection and replacement.

OCR Pre-gate:	15 to 30 sec/truck
In-gate:	120 to 160 sec/truck
OCR Out-gate:	60 to 80 sec/truck

2.3.3 TRUCK QUEUING CAPACITY

- In-gates shall be sized to hold 15 minutes of peak truck traffic.
- Out-gates shall be sized to hold 10 minutes of peak truck traffic.

2.3.4 HOURLY PEAKING FACTOR

The ratio of the busiest hour of the busiest day within a year to the average hour on the average day:

- Hourly Truck Flow Peaking Factor: 1.8 (Assumes no reservation system)

2.3.5 GATE OPERATION HOURS PER DAY

The number of hours that the truck gates are opened:

- Gate Operating Hours: 07h00 – 16h00

2.3.6 EVENING GATE VOLUMES

On average 0% of daily volume will move through truck gates between 16h00 and 23h00

2.3.7 DOUBLE TRANSACTION PERCENTAGE

The percentage of trucks performing two transactions:

- 30%

2.3.8 GATE TEUS VS. VESSEL TEUS

The ratio of truck gate TEUs over local vessel TEUs:

- 1.3

2.4 GENERAL TERMINAL PLANNING CRITERIA

2.4.1 TEU TO CONTAINER RATIO

The TEU to container ratio factor is the ratio of TEUs to actual containers handled.

- TEU/Container Ratio: 1.75

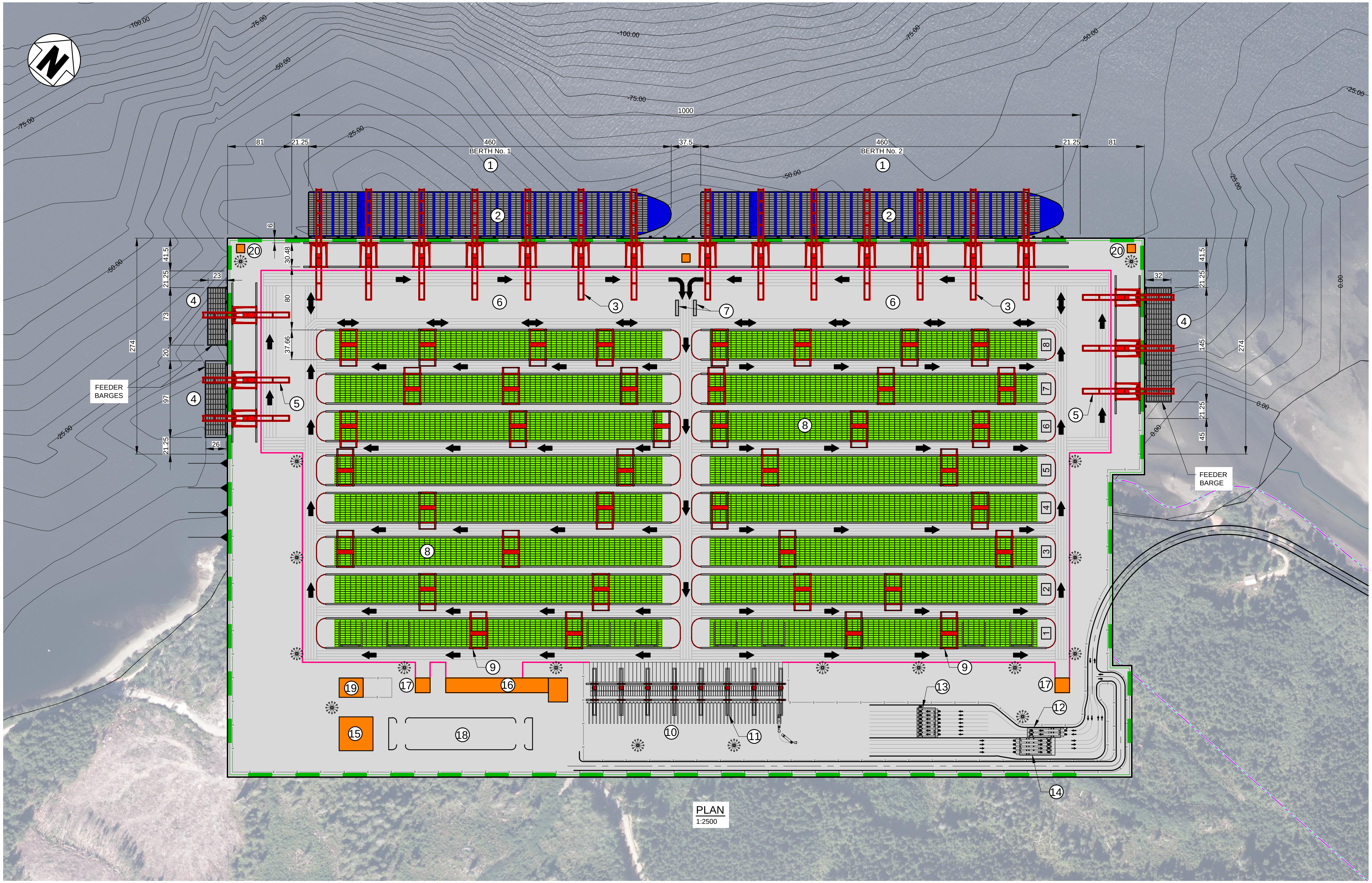
2.4.2 TERMINAL OPERATING HOURS PER DAY

Manned Operations:	22.5 hours
Automated Container Yard:	24 hours

2.4.3 TERMINAL OPERATING DAYS PER YEAR

- 357.5

Appendix C GENERAL ARRANGEMENT DRAWINGS



PLAN
1:2500

LEGEND:

▬ ▬	TERMINAL BOUNDARY
—X—	TERMINAL SECURITY FENCE
—	SAFETY FENCE - AUTOMATED AREA
➡	DIRECTION OF AGV TRAVEL
—	AGV PATHS
🟩	RAIL MOUNTED GANTRY (RMG) GROUNDED CONTAINERS
🟦	GROUNDED REEFERS
🟧	ANCILLARY BUILDING
✳	HIGH MAST LIGHT

STATIC CAPACITY:

11,904 TGS @ 5 HIGH = 59,520 TEU'S

KEY NOTES:

① PRIMARY BERTH
② 22,000 TEU VESSEL
③ PRIMARY QUAY CRANE - 85 TONNE (14 TOTAL)
④ FEEDER BERTH
⑤ FEEDER QUAY CRANE - 65 TONNE (6 TOTAL)
⑥ BERTH APRON
⑦ RADIATION PORTAL MONITOR (RPM)
⑧ CONTAINER YARD STACKS (12 WIDE)
⑨ RAIL MOUNTED GANTRIES (40 TOTAL)
⑩ TRUCK RECEIPT/DELIVERY AREA
⑪ ASCs (8 TOTAL)
⑫ OCR PRE-GATE (2 LANE)
⑬ RECEIVING GATE (7 LANE)
⑭ DELIVERY GATE OCR (4 LANE)
⑮ ADMINISTRATION BLDG. 2-STORY (39,000FT²)
⑯ MAINTENANCE BLDG. (41,500FT²)
⑰ AGV BATTERY EXCHANGE BLDG.
⑱ POV PARKING
⑲ SUBSTATION
⑳ MARINE AMENITIES BLDG.

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CLIENT:
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
GENERAL ARRANGEMENT - ALTERNATIVE

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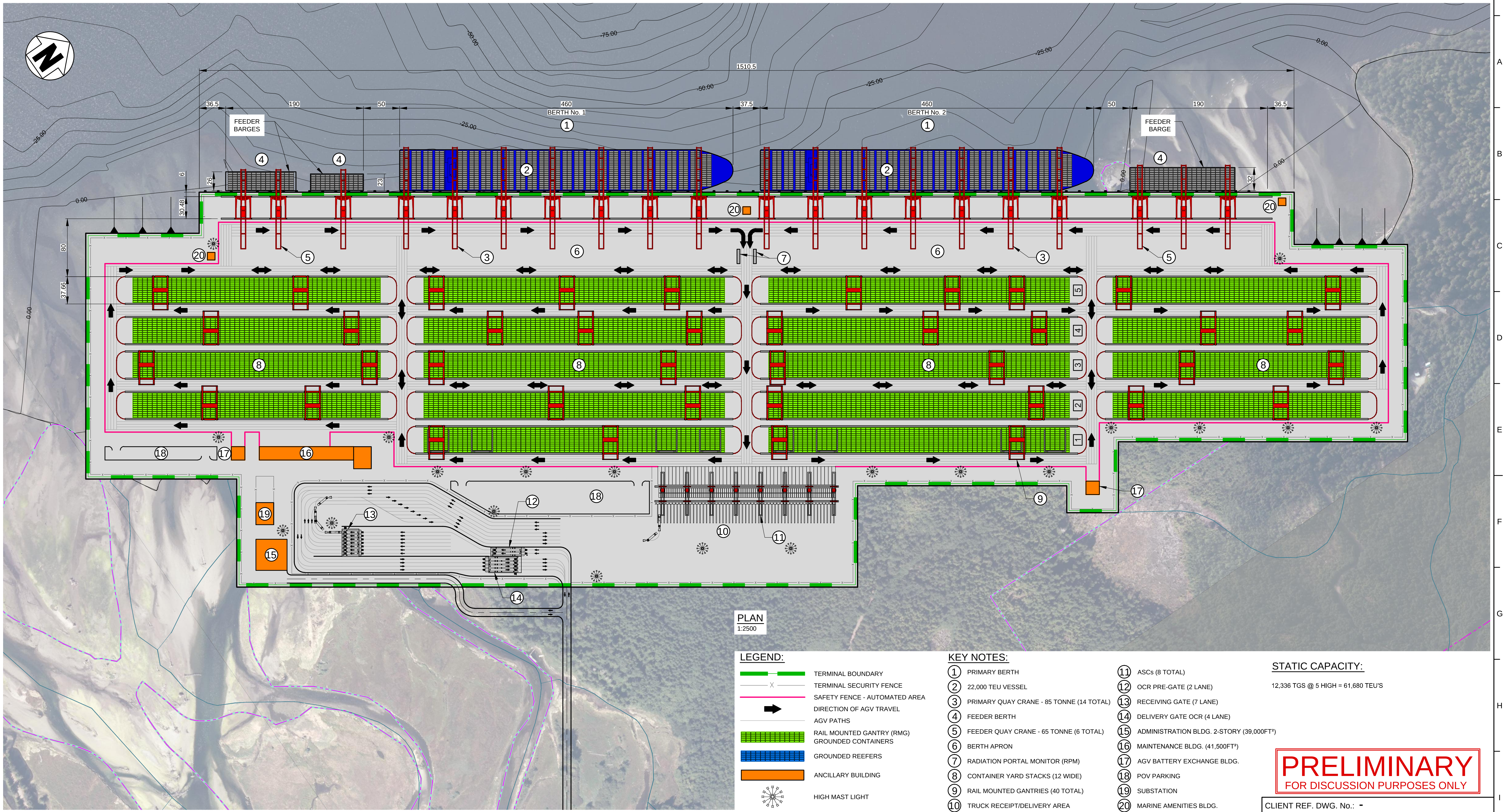

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LEGEND:

▬▬	TERMINAL BOUNDARY
—X—	TERMINAL SECURITY FENCE
—	SAFETY FENCE - AUTOMATED AREA
➡	DIRECTION OF AGV TRAVEL
—	AGV PATHS
🟩	RAIL MOUNTED GANTRY (RMG) GROUNDED CONTAINERS
🟦	GROUNDED REEFERS
🟧	ANCILLARY BUILDING
✳	HIGH MAST LIGHT

KEY NOTES:

① PRIMARY BERTH
② 22,000 TEU VESSEL
③ PRIMARY QUAY CRANE - 85 TONNE (14 TOTAL)
④ FEEDER BERTH
⑤ FEEDER QUAY CRANE - 65 TONNE (6 TOTAL)
⑥ BERTH APRON
⑦ RADIATION PORTAL MONITOR (RPM)
⑧ CONTAINER YARD STACKS (12 WIDE)
⑨ RAIL MOUNTED GANTRIES (40 TOTAL)
⑩ TRUCK RECEIPT/DELIVERY AREA
⑪ ASCs (8 TOTAL)
⑫ OCR PRE-GATE (2 LANE)
⑬ RECEIVING GATE (7 LANE)
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⑯ MAINTENANCE BLDG. (41,500FT²)
⑰ AGV BATTERY EXCHANGE BLDG.
⑱ POV PARKING
⑲ SUBSTATION
⑳ MARINE AMENITIES BLDG.

STATIC CAPACITY:

12,336 TGS @ 5 HIGH = 61,680 TEU'S

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FOR DISCUSSION PURPOSES ONLY

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REF.	DRAWING NUMBER	DRAWING TITLE

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CLIENT:
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Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
GENERAL ARRANGEMENT

D
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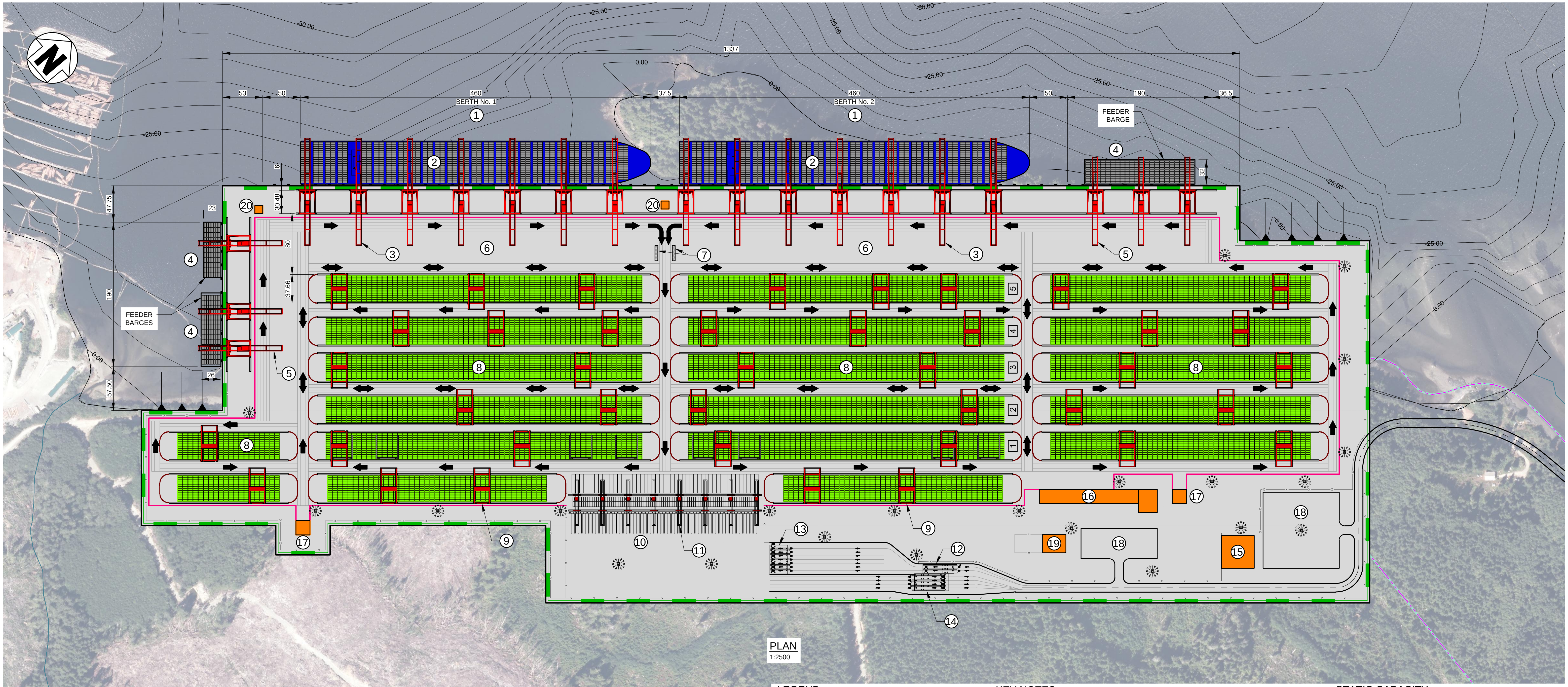

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LEGEND:

🟩	TERMINAL BOUNDARY
——X——	TERMINAL SECURITY FENCE
——	SAFETY FENCE - AUTOMATED AREA
➡	DIRECTION OF AGV TRAVEL
——	AGV PATHS
🟩	RAIL MOUNTED GANTRY (RMG) GROUNDED CONTAINERS
🟦	GROUNDED REEFERS
🟧	ANCILLARY BUILDING
✳	HIGH MAST LIGHT

KEY NOTES:

①	PRIMARY BERTH	⑪	ASCs (8 TOTAL)
②	22,000 TEU VESSEL	⑫	OCR PRE-GATE (2 LANE)
③	PRIMARY QUAY CRANE - 85 TONNE (14 TOTAL)	⑬	RECEIVING GATE (7 LANE)
④	FEEDER BERTH	⑭	DELIVERY GATE OCR (4 LANE)
⑤	FEEDER QUAY CRANE - 65 TONNE (6 TOTAL)	⑮	ADMINISTRATION BLDG. 2-STORY (39,000FT²)
⑥	BERTH APRON	⑯	MAINTENANCE BLDG. (41,500FT²)
⑦	RADIATION PORTAL MONITOR (RPM)	⑰	AGV BATTERY EXCHANGE BLDG.
⑧	CONTAINER YARD STACKS (12 WIDE)	⑱	POV PARKING
⑨	RAIL MOUNTED GANTRIES (40 TOTAL)	⑲	SUBSTATION
⑩	TRUCK RECEIPT/DELIVERY AREA	⑳	MARINE AMENITIES BLDG.

STATIC CAPACITY:

12,012 TGS @ 5 HIGH = 60,060 TEU'S

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CLIENT:
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Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
GENERAL ARRANGEMENT

D
PROJECT/DWG No.: 329510-PO-100-S0-0005
REV No B

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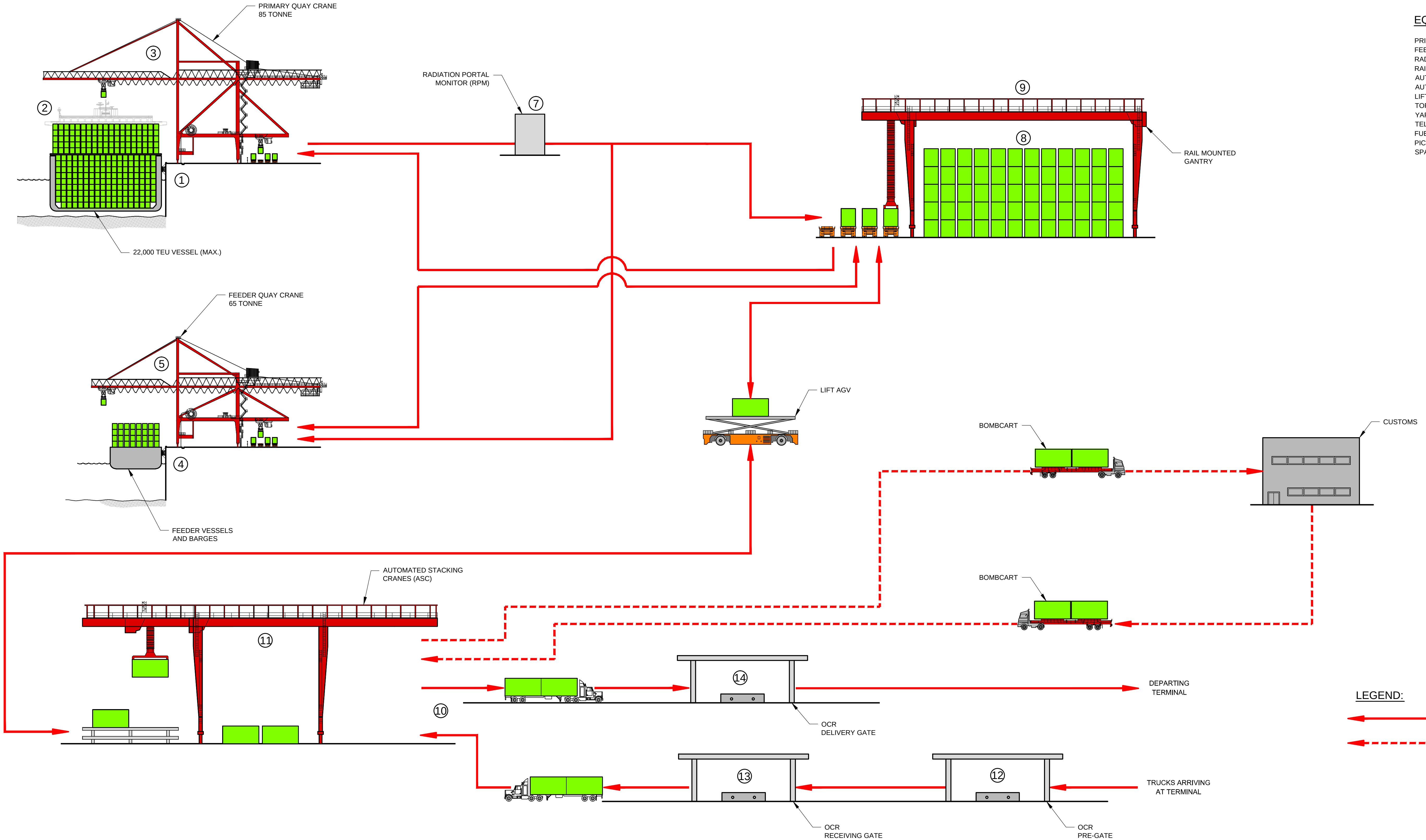
Appendix D PROCESS FLOW DIAGRAM



EQUIPMENT QUANTITIES:

PRIMARY QUAY CRANE - 85 TONNE = 14
FEEDER QUAY CRANE - 65 TONNE = 6
RADIATION PORTAL MONITOR (RPM) = 2
RAIL MOUNTED GANTRIES (RMG) = 40
AUTOMATED STACKING CRANES (ASC) = 8
AUTOMATED GUIDED VEHICLES (AGV) = 136
LIFT AGV = 8
TOP PICK CONTAINER HANDLER = 1
YARD HUSTLER AND BOMBCART = 2
TELESCOPIC HANDLERS = 1
FUEL/REPAIR TRUCKS = 4
PICKUP TRUCKS = 20
SPARE STS SPREADERS = 5

LEGEND:

⟵	MAIN CONTAINER FLOW BY AGV (UNLESS SHOWN)
⇠	SECONDARY CONTAINER FLOW
①	NUMBERS REFER TO KEY NOTES ON DWGS. 329510-PO-100-S0-0002 & 0005

REF.	DRAWING NUMBER	DRAWING TITLE

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SCALE: NTS

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
CONTAINER TRANSSHIPMENT TERMINAL
PROCESS FLOW DIAGRAM

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Appendix E DESIGN CRITERIA

Hatch Mott
MacDonald

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY

Design Criteria

Prepared for:

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329510-PM-230-S0-0003 Rev A

Document Number	329510-PM-230-S0-0003	Rev A

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Rev.	**Description**	**Originator**	**Checker**	**Approver**	**Date**
A	Issued for Client Review	Wilson Mak	Andrew Smitten	Tony Martin	2014 04 25

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TABLE OF CONTENTS

1 PROJECT DEFINITION

The purpose of this document is to set out the criteria that will be used in the design of the basic concepts to determine Order of Magnitude costing and proposed for use for the next phases of design.

1.1 TITLE OF PROJECT

Port Alberni Transshipment Hub (PATH) Pre-Feasibility Study

1.2 PROJECT DESCRIPTION

The project includes the planning for a minimum two berth container handling facility within the Alberni Inlet that can handle up to two 22,000 TEU sized vessels simultaneously, with the provision to expand to a further two berths in the future. It is anticipated that every call will require full discharge and load of these trans-pacific vessels.

The majority of all containers discharged will be transferred to feeder vessels and/or dedicated cellular barges for transshipment to nearby Pacific North-West ports including Vancouver, Seattle, Tacoma and possibly Portland and Prince Rupert. The smaller feeder vessels and transshipment barges may require separate berths for discharge and loading operations.

Horizontal transport between the trans-pacific vessels and the container yard will be by automated container handling equipment. Horizontal transport between the container yard and feeder vessels and barges will also be automated.

The facility will be used to receive and transport local container traffic for Vancouver Island in the region of 200,000 TEU/yr. with potential to expand to 500,000 TEU/yr. in the future.

The mode of operation for handling in the container yard will be parallel stacking (relative to the berth) using automated rail-mounted gantries (RMG's). The facility will also include a truck gate for the receipt and delivery of container traffic generated on Vancouver Island. The container transshipment terminal facility plans will include provision for the berths, container yard, truck gates and necessary ancillary facilities including a customs facility, administration and maintenance buildings, fuel facility, etc. The multiple berth terminals may be staged in phases over a set number of years. The phased stages of the facility will allow for the following annual projected throughputs:

- Initial Phase: Two berth terminal with upland facilities to match the berth capacity.
- Future Phase: Four berth terminal with upland facilities to match the berth capacity.

1.3 PROJECT LOCATION

Three concept designs will be developed for two sites within the Sarita Bay area on the south side of the Alberni Inlet, Vancouver Island.

The sites are currently a combination of Crown Land and First Nations Treaty property. All the sites are currently undeveloped.

1.4 THROUGHPUT

- Total annualised throughput: approximately 2,500,000 TEU/y.

2 DESIGN STANDARDS, CODES AND GUIDELINES

2.1 CODES AND STANDARDS

Design of the Project facilities should be referenced to conform to the most current version of the following codes and standards where appropriate for design and in specifications to determine loads, performance, geometry and materials:

CIVIL & STRUCTURAL

- AWWA Standard C502;
- CSA Standard A23.3 – Design of Concrete Structures;
- CSA Standard S16.1 – Steel Structures for Buildings – Limit State Design;
- Design of Highway Bridges (CAN/CSA-S6-M);
- Division 1-A of AASHTO Standard Specifications for Highway Bridges 1996;
- Master Municipal Construction Documents (MMCD) [Platinum Edition-2009] – Volume I – User Guide;
- National Building Code of Canada (NBCC);
- National Fire Code of Canada;
- NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances;
- NFPA 20 – Standard for Installation of Centrifugal Fire Pumps;
- NFPA 22 – Standard for Water Tanks for Private Fire Protection;
- NFPA 307 – Standard for the Construction and Fire Protection of Marine Terminals, Piers and Wharves;
- Sewerage System Standard Practice Manual, version 2;
- Transportation Association of Canada's (TAC's) Geometric Design Guide for BC Canadian Roads (Parts 1 and 2; September, 1999); and,
- BC supplemental to TAC Geometrics Design Guide (2007 Edition).

MARINE

- Coastal Engineering Manual, US Army Corps of Engineers;
- International Ship & Port Facility Security Code;

- PIANC – World Association for Waterborne Transport Infrastructure;
- Port Designer's Handbook: Recommendations and Guidelines, pg. 137 (Carl A. Thoresen); and,
- Transport Canada – Marine Transportation Security Regulations.

ELECTRICAL

- BC Hydro Distribution Standards Overhead Electrical (ES 43);
- BC Ministry of Transportation and Infrastructure (MoTI);
- CSA C22.1 - Canadian Electrical Code; and,
- Illuminating Engineering Society (IES).

SAFETY

3 WORKSAFEBC.PROJECT DATUM AND MEASUREMENT

3.1 UNITS OF MEASUREMENT

Metric units shall be presented throughout this project. Design calculations shall generally be completely in metric units.

The following units will be used as required:

TABLE 3-1 PROJECT UNITS OF MEASUREMENT

Measurement Type	Units
Annual Throughput	TEU/y (total equivalent units per year)
Capacity	t/h (tonnes per hour)
Length	mm (millimetres) or m (metres)
Area	m^2 (square metres)
Volume	m^3 (cubic metres)
Mass	t (tonnes)
Elevation, Wave Heights, Ship Dimensions	m (metres)
Ship Displacements	t (tonnes)
Forces	kN (kilo-Newtons)
Moment and Torsion	kNm (kilo-Newton metres)
Power	kW (kilowatts) or hp (horsepower)
Speed	km/h (kilometres per hour)

3.2 PROJECT DATUM

Chart datum in metric units is the project vertical datum, unless otherwise noted.

Local Hydrographic Tide and Chart Datum in metric units is often used for bathymetric surveys. Based on data provided in the Alberni Inlet hydrographic chart, 0.0 m Canadian Hydrographic Services Chart Datum (CD) at the site is equal to -1.9 m Geodetic Datum (GD).

3.3 PROJECT GRID

Plan measurements are planar using UTM coordinates in metres based on the North American Datum 1983 (NAD 83) within UTM Zone 10U.

3.4 SURVEY CONTROL

Survey controls will be based on existing monuments and benchmarks identified by the Port Alberni Port Authority.

4 SERVICE LIFE

The design life for all equipment and structures will be designed in accordance with the following:

- New marine structures shall be designed for a minimum service life of 50 years subject to the appropriate levels of maintenance. Note that this service life does not apply to any previously installed structures that are not being modified.
- The new berth fender and mooring systems (if required) shall be designed for a minimum service life of 25 years.
- Terminal pavements shall be designed for a minimum service life of 20 years subject to the appropriate levels of maintenance.
- On shore structures shall be designed for a minimum service life of 50 years subject to appropriate levels of regular maintenance.
- Mechanical, electrical and control equipment shall be designed for a minimum service life of 25 years subject to appropriate levels of regular maintenance.

The term “service life” as used above is defined as the time period during which it is economically feasible to conduct regularly scheduled maintenance and periodic refurbishment of mechanical and structural facilities to maintain the performance and safety standards as designed.

5 ENVIRONMENTAL LOADS

Environmental loads derived from data published in Table C-2 of the NBCC.

5.1 WIND

TABLE 5-1 DESIGN WIND LOADS

Return Period	Hourly Wind Pressures, kPa
1/10	0.47
1/50	0.63

5.2 SNOW

TABLE 5-2 DESIGN SNOW LOADS

Return Period, 1/50	Ground Snow Load, kPa
S_s	3.0
S_r	0.4

5.3 TEMPERATURE

TABLE 5-3 DESIGN TEMPERATURES

	Temperature, ˚C
Maximum Daily	31
Minimum Daily	-7

5.4 RAIN

TABLE 5-4 DESIGN RAINFALL

Duration	Rainfall, mm
15 Minutes	10
One Day	161
Annual Total Precipitation	2,000

5.5 SEISMIC

The peak firm ground accelerations (PGA) for the various probabilities of exceedance will be as provided in Table C-2 of the NBCC, Table J-2 of the User’s Guide to the NBCC, and Natural Resources Canada’s 2010 NBCC seismic hazard calculator. Refer to Section 6.6.3 for definition of each seismic event.

TABLE 5-5 SEISMIC DESIGN PARAMETERS

Performance Level	Probability of Annual Exceedance	Peak Horizontal Ground Acceleration (PGA), g	Probability of Exceedance in 50 years	Average Return Period, years
OLE	1.0000%	0.089	40%	100
LSE	0.0404%	0.453	2%	2,475

6 MARINE

6.1 WATER LEVELS (TIDAL DATA)

Water levels are measured from local Hydrographic Tide and Chart Datum detailed on Canadian Hydrographic Services (CHS) Chart 3668:

TABLE 6-1 DESIGN WATER LEVELS

Water Levels	Elevation above Chart Datum, m
High-High Water, Large Tide (HHWLT)	3.9
High-High Water, Mean Tide (HHWMT)	3.1
Mean Water Level (MWL)	1.9
Low-Low Water, Mean Tide (LLWMT)	0.4
Low-Low Water, Large Tide (LLWLT)	-0.2

6.2 WATER DEPTHS

Depth of water required at the main berth will be 18.7 m below Chart Datum.

Depth of water required at the feeder berth will be 8.4 m below Chart Datum.

6.3 CURRENTS AND WAVES

Currents are greatly influenced by the winds. Wave studies to be undertaken prior to detailed design phase.

6.4 DESIGN VESSELS

The fendering system shall be designed as recommended in the PIANC Guidelines for the Design of Fender Systems. Further confirmation by the designer of actual berthing criteria at the Port is recommended.

The design vessels will be Post-Panamax container vessels that ply the trans-pacific lanes. They are expected to range between 10,000 TEU to 22,000 TEUs.

TABLE 6-2 PRIMARY VESSELS

Vessel Parameters	10,000 TEU	22,000 TEU*
TEU Capacity	9,954	22,000
Max. Vessel LOA, m	350.1	460.0
Max. Vessel Beam, m	48.2	60.0
Max. Vessel Loaded Draft, m	15.0	16.0
Max. Vessel DWT, t	124,479	210,000
Required Water Depth @ 0.0 CD, m	17.6	18.7
Approach velocity perpendicular to the berth face, m/s:	0.102	0.10
Approach angle, degrees:	10	10
Impact Point from Bow:	¼ point	¼ point
Allowable Hull Pressure, t/m2:	25	25
** Data sourced from industry expectations and/or extrapolated from World Fleet Registry*		

Feeder vessels and cellular barges will be utilized for local transshipment with the following dimensions:

TABLE 6-3 FEEDER VESSELS

Vessel Parameters	1,000 TEU	2,500 TEU
TEU Capacity	1,000	2,500
Max. Vessel LOA, m	164.0	226.5
Max. Vessel Beam, m	25.0	32.3
Max. Vessel Loaded Draft, m	9.8	12.0
Max. Vessel DWT, t	20,156	41,830
Required Water Depth @ 0.0 CD, m	11.6	14.1
Approach velocity perpendicular to the berth face, m/s:	0.205	0.157
Approach angle, degrees:	10	10
Impact Point from Bow:	¼ point	¼ point
Allowable Hull Pressure, t/m2:	25	25

TABLE 6-4 CELLULAR BARGES

Vessel Parameters	300 TEU	600 TEU	1,200 TEU
TEU Capacity	300	600	1,200
Max. Vessel LOA, m	73.0	97.0	145.0
Max. Vessel Beam, m	23.0	26.0	32.0
Max. Vessel Loaded Draft, m	5.5	6.0	7.0
Required Water Depth @ 0.0 CD, m	6.6	7.2	8.4
Approach velocity perpendicular to the berth face, m/s:	0.250		
Approach angle, degrees:	10		
Impact Point from Bow:	¼ point		
Allowable Hull Pressure, t/m2:	25		

6.5 MOORING

Bollards shall be designed to resist the most severe load combination of wind, wave and current. The mooring analysis shall consider the full range of design vessels at high and low tide levels.

The wind speed to be used for the mooring analysis will be a wind with 50 year mean recurrence interval, corrected for a 30 second gust duration and wind spectral effects. Wind directionality effects will be included consistent with available wind records from nearby sources.

6.6 WHARF LOADS

6.6.1 DEAD LOADS

Dead loads on the wharf shall be the self-weight of all fixed structures, materials and permanently fixed appurtenances.

6.6.2 UNIFORM LIVE LOADS

ALL AREAS

- Container Wharf UDL for Long Term Settlement: 10 kPa

FRONT WHARF APRON

- Container wharf UDL outboard of the waterside crane rail: 24 kPa
- Design Load: CL-625, as per CSA-S6

PORTAL

The uniformly distributed storage load on the wharf from the container stacks shall be:

- 40 foot containers stacked 2 high (27 t per container):
    - UDL 38 kPa
    - Corner Load 1,140 kN

Uniform Distributed Storage Load on the wharf when simultaneous container crane wheel loads are applied shall be 15 kPa. Under this loading scenario, the uniformly distributed storage load need not be applied within 1.5 meters of either side of the landside or waterside crane rails.

- Hatch covers:
    - UDL 15 kPa
    - Self-Weight (each) 285 kN
    - Corner Load (stacked five high) 430 kN
    - An impact allowance of 20% will be added to the above loads.
- Design Load: CL-625, as per CSA-S6

BACKREACH WHARF APRON AREAS

Container stacking and storage:

- Automated Guided Vehicles (AGVs):
    - Wheel Base 8.8 m
    - AGV Width 3.0 m
    - Maximum Payload 590 kN
    - Tire Size (one each corner) 18.00 R25 (inches)
    - Self-Weight 245 kN
    - Max. Tire Pressure: 9.6 bar

SHIP TO SHORE GANTRY CRANES

The following equipment loads shall be considered. An impact allowance loading shall be added to the loads.

PATH shall be designed for 80 t “Tandem 40” Post-Panamax container cranes with a rail gauge of 30.48 m.

The crane is designed for handling ISO Containers 6.1 m, 12.2 m and 13.7 m lengths with the following Safe Working Loads (SWL):

TABLE 6-5 SHIP TO SHORE GANTRY CRANE CAPACITIES

Parameter	Value
Tandem Lift Operation (2x 40 ft Containers, Unlimited Outreach / Back Reach) Capacity under Tandem Spreader Arrangement:	80.00 t
Single Lift Operation (Unlimited Outreach / Back Reach) Capacity under Single Lift Arrangement	40.00 t
General Cargo (with Hook Beam, Unlimited Outreach / Back Reach) Capacity under Hook Beam	75.00 t
Heavy Lift (with Hook Beam, Unlimited Outreach / Back Reach) Capacity under Hook Beam	90.00 t
Operating Wind Speed	90.0 km/h
Stored Wind Speed (Capacity of Stowage Pins)	150.0 km/h

The maximum load occurs on the waterside rail when the load being lifted is at the extreme end of the derrick boom. The maximum load occurs on the landside rail when the load being lifted is at its furthermost inland point from the landside rail with the boom down.

Preliminary data for an 80 t “Tandem 40” Container Crane, is as follows:

- Dead weight: 1,900 t
- Lifting capacity: 80.00 t
- Truck arrangement: 4 trucks, 8 wheels per truck
- Distance between wheels at each truck:
  1.375 m for Design Case I (minimum), or
  1.500 m for Design Case II (maximum)
- Distance between the load centres of the two corners on a rail:
  13.3 m for Case I (i.e. 3.675 m gap between centre wheels), or
  14.1 m for Case II (i.e. 3.60 m gap between centre wheels)
- Overall length of crane (bumper to bumper): 27.0 m
  (Note: this exceeds the commonly used value of 86’6” by about 24”)
- Location of stowage pin slot, offset from rail centerline: 415 mm
- Normal Operating Condition:
  - Waterside Wheel Load 115 t/wheel

  - Landside Wheel Load 90 t/wheel
- Extreme Operating Condition (unfactored):
  - Waterside Wheel Load 130 t/wheel
  - Landside Wheel Load 105 t/wheel
- Earthquake Condition:
  - Waterside Wheel Load 135 t/wheel
  - Landside Wheel Load 120 t/wheel
- Stowed (Storm Wind) Condition:
  - Waterside Wheel Load 130 t/wheel
  - Landside Wheel Load 110 t/wheel
  - Max. Lateral Load, applied at top of rail 18.6 t/wheel

Buffer (impact load): Crane buffers (stops) shall be designed to resist a horizontal impacting force of 1,500 kN for each rail, applied 1.8 m above the top of the rail, and in a direction parallel to the rail.

6.6.3 SEISMIC LOADS

A probabilistic and risk based performance criteria is established for the project. The base peak firm ground accelerations for the various probabilities of exceedance have been determined based on site-specific ground motion parameters obtained from Geological Survey of Canada (GSC) and modified for the for site response values for the Project. The accompanying geotechnical assessments for liquefaction for the project site provide these site-specific ground motion parameters.

The performance criteria for the level of acceptable seismic damage are based on two seismic events.

OPERATING LEVEL EARTHQUAKE (OLE)

The OLE is defined as the seismic event that produces ground motions associated with a 100-year return period which equates to a 40% probability of being exceeded in 50 years. The OLE is a more frequent occurrence, and the associated structural damage is repairable, and mainly superficial in nature. After the OLE event, the wharf should have minimal, if any, interruption of operations. The OLE level of associated damage precludes any loss of life.

LIFE SAFETY EARTHQUAKE (LSE)

The LSE is a major seismic event with a return period of 2,475 years which equates to a 2% chance of being exceeded in 50 years. After an LSE event, there may be complete loss of operations, with non-repairable damage to the structure. The LSE level of associated damage precludes any loss of life.

The seismic mass associated with the yard and apron loads is assumed to be 10% of the design live load.

The response frequency separation between the gantry crane and wharf is large enough to essentially isolate the higher period crane from the lower period wharf. As such, the horizontal seismic mass associated with the gantry crane need not be included with the seismic analysis.

The vertical seismic forces resulting from the rocking motion of the crane under seismic motions shall be considered. If crane tie-downs are utilized, the additional dynamic restraining forces shall also be considered.

7 CIVIL AND UTILITY WORKS

This section presents the design criteria for the Civil and Utility works for the PATH project. The criteria include the following elements:

- Terminal site grading;
- Access roads; and,
- Terminal's internal roads.

7.1 TERMINAL SITE GRADING

The main design criteria for the site grading work in this project are summarized in Table 7-2 below:

TABLE 7-1 DESIGN CRITERIA - SITE GRADING

Description	Design Criteria
Site Grading	
Side slopes	2H:1V
Back slopes	2H:1V
Rock-cut side slope	≤70 degrees
Rock-cut back slopes	≤70 degrees
Area 1 – Pavement Type (Automated Area)	
Design Vehicle	AGV
Surface Type	Paved
Lane Width	4 m
Pavement Structure – 19 mm minus Asphalt – Top Lift	50 mm
Pavement Structure – 19 mm minus Asphalt – Bottom Lift	150 mm; 2 lifts (75 mm each)
Pavement Structure – 50 mm minus Crushed Base Course (CBC) gravel base	200 mm

Description	Design Criteria
Pavement Structure – 150 mm minus CBC gravel sub-base on rock	600 mm
Maximum grade	0.25%
Area 2 – Pavement Type (Parking Areas and On-Site Access Roads)	
Design Vehicle	WB-20
Surface Type	Paved
Pavement Structure – 19 mm minus Asphalt	75 mm
Pavement Structure – 50 mm minus CBC gravel base	100 mm
Pavement Structure – 150 mm minus CBC gravel sub-base on rock	200 mm

7.2 ACCESS ROADS

The main design criteria for the roads proposed in this project are summarized in Table 7-2 below:

TABLE 7-2 DESIGN CRITERIA – ROADS

Description	Design Criteria
Off-Site Access Roads	
Design Vehicle	WB-20
Design Speed	50 km/h
Minimum Horizontal Curve Radius	90 m
Maximum Super-elevation	0.06 m/m
Minimum Sag K Value (Based on headlight control)	12
Maximum grade	8%
Stopping Sight Distance (SSD)	65 m
Design Year Traffic AADT	1,500 vehicles per day
Surface Type	Gravel
Lane Width	3.5 m
Shoulder Type	Gravel
Shoulder Width (Useable)	1.0 m
Shoulder Rounding	0.6 m
Finished Top Width	9 m

Description	Design Criteria
Normal X-Fall	0.02 m/m
Ditch width	1 m
Gravel wearing surface: 40% - 60% stone – 6 mm to 38 mm 20% - 60% sand – 6 mm minus 8% - 15% fines	200 mm
Pavement Structure - 50 mm minus CBC gravel base	300 mm
Terminal Low-Volume Area	
Surface Type	Gravel
Gravel wearing surface: 40% - 60% stone – 6 mm to 38 mm 20% - 60% sand – 6 mm minus 8% - 15% fines	200 mm
Pavement Structure - 50 mm minus CBC gravel base	300 mm

7.3 STORM WATER MANAGEMENT

Site and road drainage is to accommodate the storm water flows derived from the Rainfall Intensity curves for the Port Alberni area. The Intensity-Duration-Frequency-Constants for the Port Alberni Weather Station (based on the period 1969 to 1993) is shown in Table 7-3 below.

TABLE 7-3 INTENSITY-DURATION-FREQUENCY CONSTANTS – PORT ALBERNI WEATHER STATION

Frequency	Constant A	Constant B
2-Year	12.1	-0.369
5-Year	16	-0.418
10-Year	18.6	-0.439
25-Year	21.7	-0.459
50-Year	24.1	-0.471
100-Year	26.4	-0.480

The rainfall intensity formula that ties to the above constants A & B in Table 7-3 is:

$$I = AT^B$$

Where,

I = Rainfall intensity, mm/h

T = Rainfall duration, hours

The Intensity Duration-Frequency (IDF) curve for the Port Alberni Weather Station is shown in Figure 7-1 below:

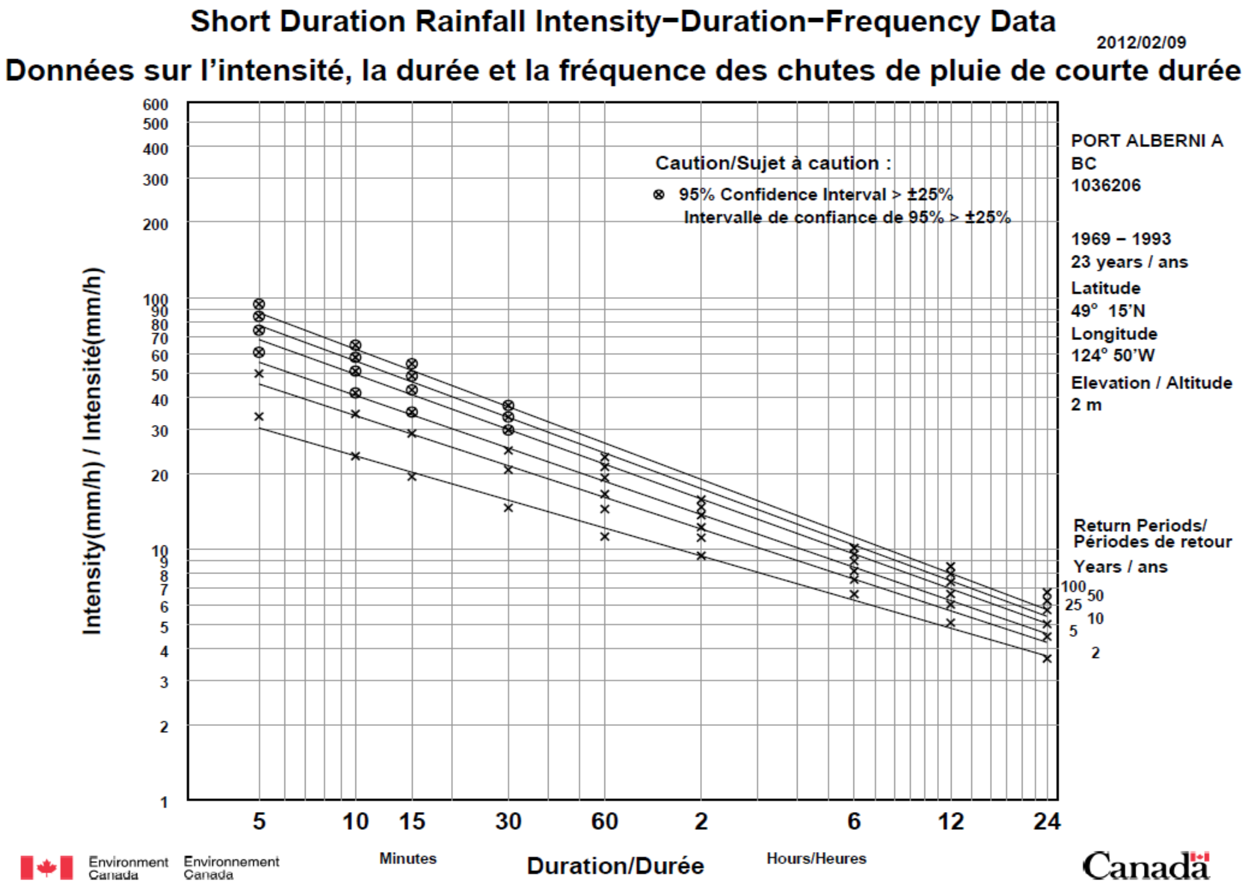


FIGURE 7-1 IDF CURVE FOR PORT ALBERNI, BC

7.3.1 CULVERTS

Corrugated Steel Pipe Culvert (CSP) will be used.

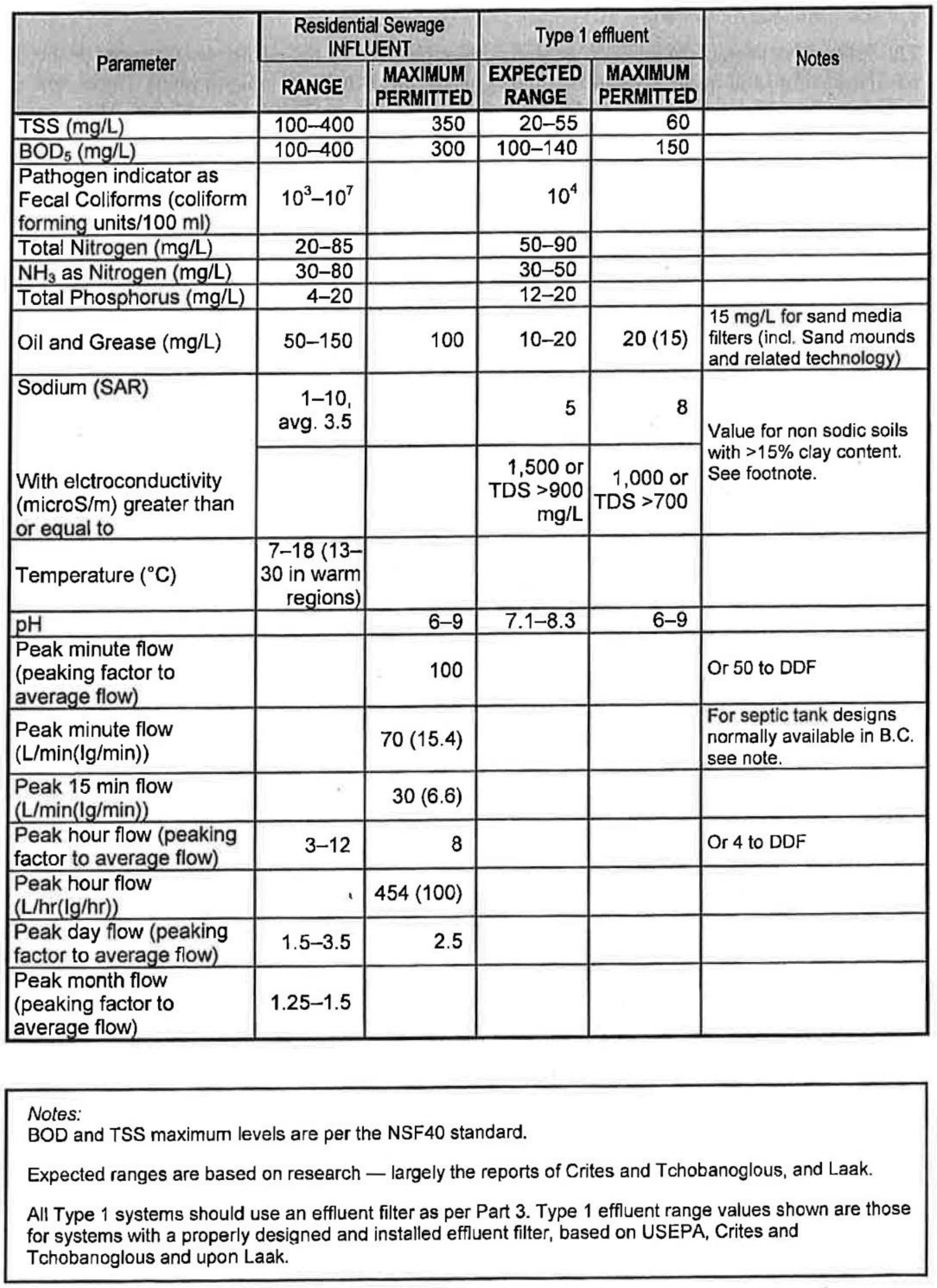
7.4 SANITATION

This section establishes the sanitation design criteria for project.

7.4.1 LEVELS OF TREATMENT

The proposed level of treatment (pre-treatment) before discharge into the ground is Type 1. Type 1 is treatment by septic tank. Refer to Table 7-4 below for the Type 1 effluent quality.

TABLE 7-4 TYPE 1 EFFLUENT QUALITY



Parameter	Residential Sewage INFLUENT		Type 1 effluent		Notes
	RANGE	MAXIMUM PERMITTED	EXPECTED RANGE	MAXIMUM PERMITTED	
TSS (mg/L)	100–400	350	20–55	60	
BOD_5 (mg/L)	100–400	300	100–140	150	
Pathogen indicator as Fecal Coliforms (coliform forming units/100 ml)	10^3–10^7		10^4		
Total Nitrogen (mg/L)	20–85		50–90		
NH_3 as Nitrogen (mg/L)	30–80		30–50		
Total Phosphorus (mg/L)	4–20		12–20		
Oil and Grease (mg/L)	50–150	100	10–20	20 (15)	15 mg/L for sand media filters (incl. Sand mounds and related technology)
Sodium (SAR)	1–10, avg. 3.5		5	8	Value for non sodic soils with >15% clay content. See footnote.
With elctroconductivity (microS/m) greater than or equal to			1,500 or TDS >900 mg/L	1,000 or TDS >700	
Temperature (°C)	7–18 (13–30 in warm regions)				
pH		6–9	7.1–8.3	6–9	
Peak minute flow (peaking factor to average flow)		100			Or 50 to DDF
Peak minute flow (L/min(Ig/min))		70 (15.4)			For septic tank designs normally available in B.C. see note.
Peak 15 min flow (L/min(Ig/min))		30 (6.6)			
Peak hour flow (peaking factor to average flow)	3–12	8			Or 4 to DDF
Peak hour flow (L/hr(Ig/hr))		454 (100)			
Peak day flow (peaking factor to average flow)	1.5–3.5	2.5			
Peak month flow (peaking factor to average flow)	1.25–1.5				

Notes:
BOD and TSS maximum levels are per the NSF40 standard.

Expected ranges are based on research — largely the reports of Crites and Tchobanoglous, and Laak.

All Type 1 systems should use an effluent filter as per Part 3. Type 1 effluent range values shown are those for systems with a properly designed and installed effluent filter, based on USEPA, Crites and Tchobanoglous and upon Laak.

7.5 FIRE PROTECTION

7.5.1 FIRE WATER RING MAIN

Design Flow Rate:	3,331 L/s
Design Flow Velocity:	3 m/s to 6 m/s

Fire Water Main Size:	DN150 minimum

7.5.2 Fire Hydrants

Minimum Pressure Rating:	1,720 kPa
Location:	90 m radius spacing; within 6 m of roadway

All connections shall come with caps and a 380 mm diameter hand wheel to operate the valve.

The pumper connection shall typically face the road and be approximately 460 mm above buried finished grade to facilitate hook up to the fire truck.

7.5.3 Fire Water Pumps

Application:	Fresh water
Back-up Capacity:	100%
Power Supply:	electric driven with back-up power or diesel-fired
Location:	Dedicated building, 15m away from other facilities
Automatic Start:	System pressure below 800 kPa

8 Electrical

8.1 Power Supply

It is proposed to run a new power transmission line to the facility.

The power line will be designed to conform to BC Hydro Distribution Standards Overhead Electrical (ES 43).

The power line will be designed with primary conductors at a height which will permit a telecommunications line to be installed below and still maintain sufficient clearance for road crossings.

Road crossing clearances will be as per ES-43 and BC MoTI – Infrastructure Utility Policy Manual.

8.2 Communications

Site communications will be supplied by a communications line co-located on the power transmission line. The communications line will be designed to conform to BC Hydro Distribution Standards Overhead Electrical (ES 43).

The communications line will preferably be a fibre-optic type communications cable.

The line may be supplied and installed by Telus or other local telecommunications provider.

8.3 SITE ELECTRICAL

The power line will feed a substation located within the facility. Power will be distributed throughout the facility via underground duct banks. Step-down transformers and electrical rooms will be strategically placed to facilitate power distribution to the equipment throughout the facility.

8.4 ILLUMINATION

Lighting intensities shall be based on IES recommendations and WorkSafeBC OHS Regulation Part 4.

Roadway lighting for the access road to the site will be based on BC MoTI – Electrical and Traffic Engineering Design Guidelines – Section 300, Lighting Design.

Area lighting shall be provided with lighting fixtures mounted on the outside walls of the buildings or on poles if no buildings are available;

Outdoor lighting in general shall be photoelectric-cell controlled, relayed and switched via lighting contactor panels. Reflectors shall be used to direct the light downwards and minimize light pollution on adjacent properties and waterways;

Indoor lighting shall generally be controlled from circuit breaker lighting panels. Lighting in offices shall be switch controlled.

Emergency lighting will be provided for safe building egress in the event of power failures.

Reduced lighting will be provided in areas where container movement is via automated equipment.

The following table is a guide to be used in conjunction with the IES Lighting Handbook.

TABLE 8-1 ILLUMINATION LEVELS

Area	Recommended Illuminance Levels, lx
Offices	800
Warehouse	200
Access Roadway to Site	20
Loading/Unloading Areas	50
Employee Parking Areas	20
Emergency lighting for building egress	20

Appendix F PRE-FEASIBILITY DESIGN DRAWINGS

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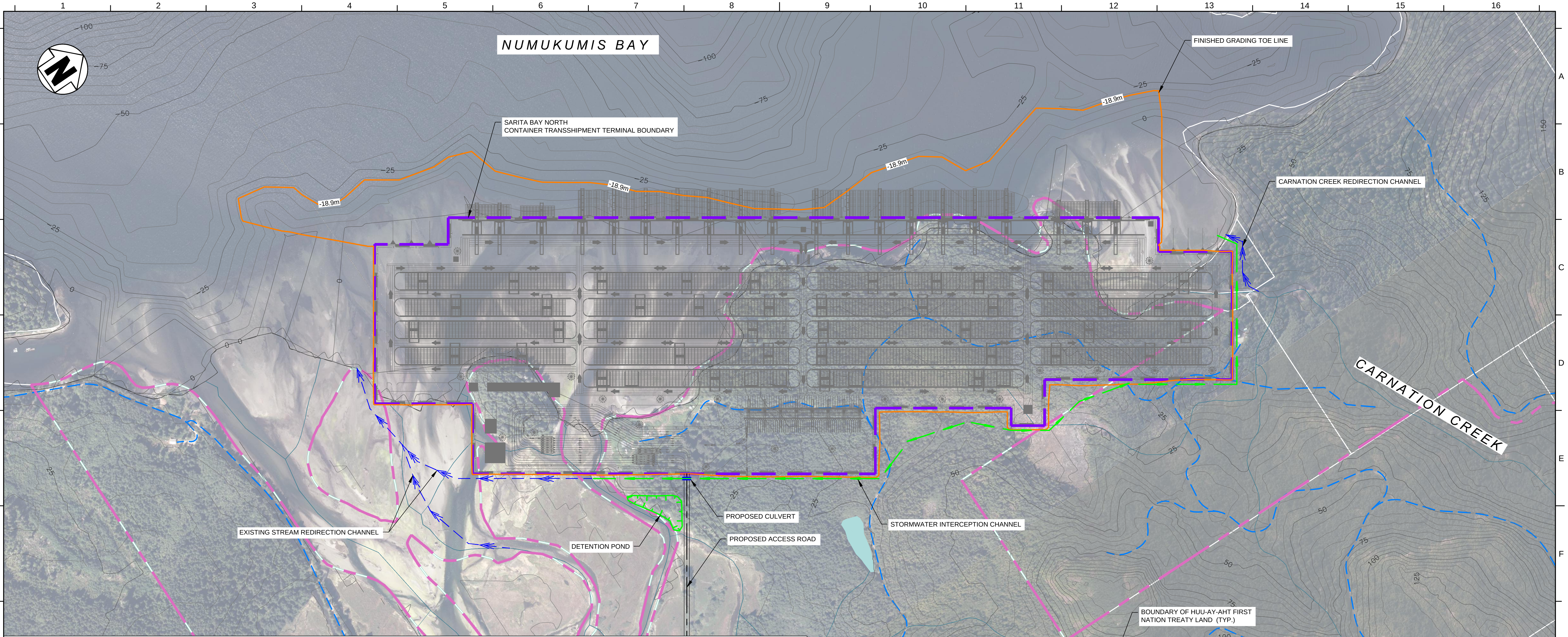

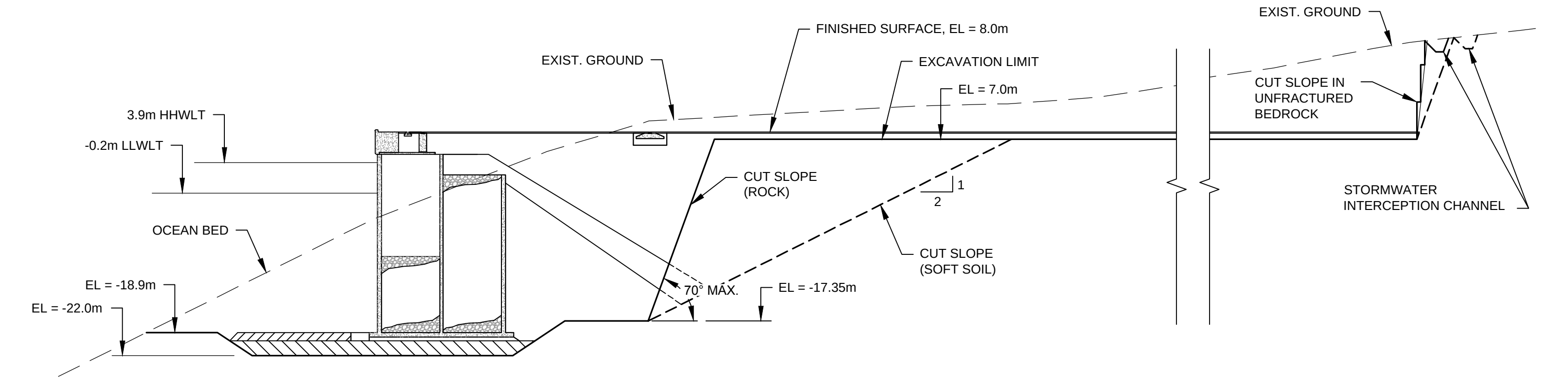

TYPICAL CROSS- SECTION

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REFERENCE DRAWINGS

LEGEND

FIRST NATION TREATY LAND BOUNDARY
EXISTING CREEK / STREAM
POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
EXISTING ROAD - UNIMPROVED
EXISTING ROAD
PROPOSED ACCESS ROAD
FINISHED GRADING TOE LINE

ENGINEER STAMP:

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CLIENT REF. DWG. No.: -

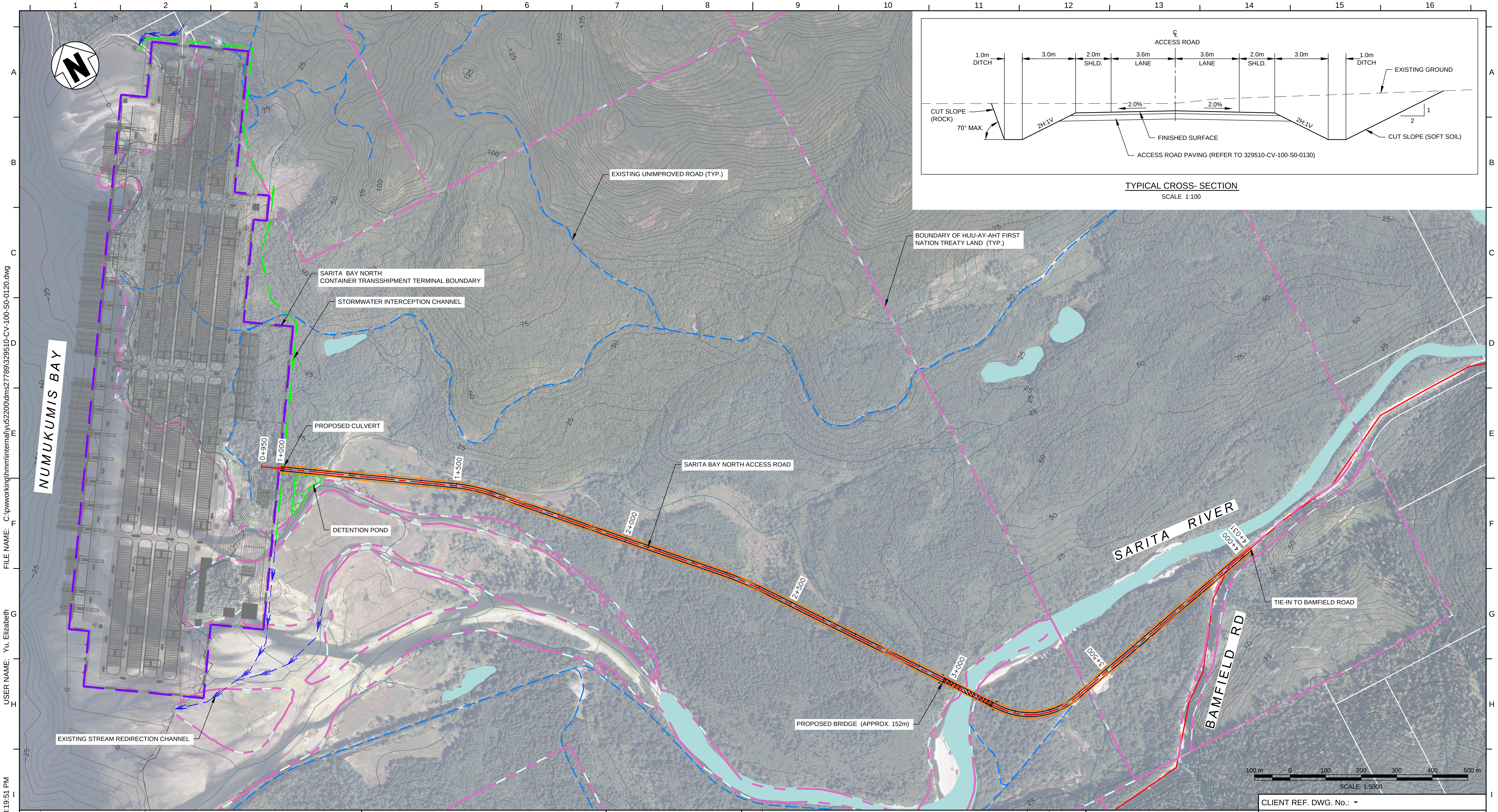
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
GRADING PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0110

REV No A



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LEGEND

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─	EXISTING CREEK / STREAM
▬ ▬ ▬	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
─ ─ ─	EXISTING ROAD - UNIMPROVED
─	EXISTING ROAD
═	PROPOSED ACCESS ROAD
─	FINISHED GRADING TOE LINE

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CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
ACCESS ROAD OVERALL PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0120

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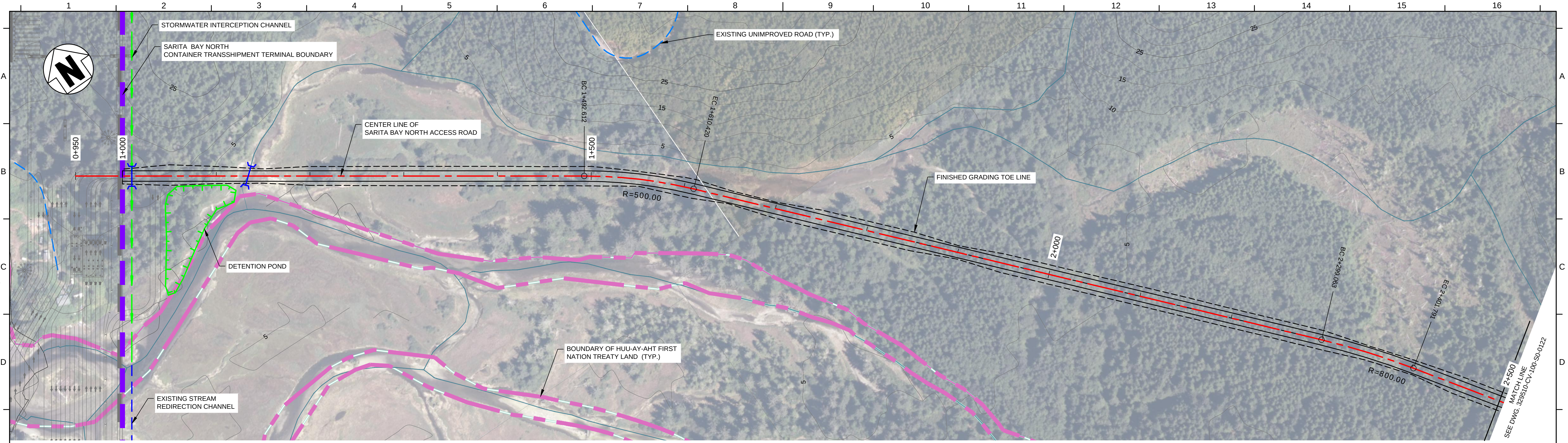

PLAN

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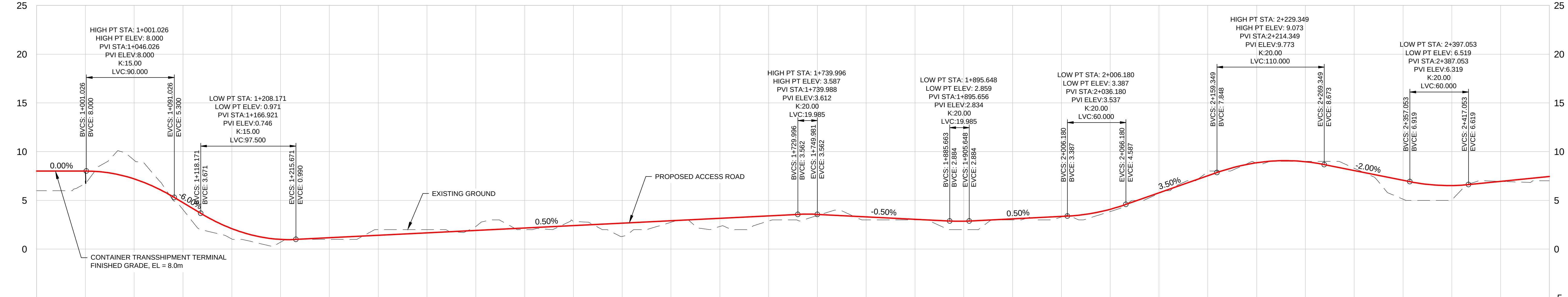

	0+950	1+000	1+100	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+900	2+000	2+100	2+200	2+300	2+400	2+500
PROPOSED	8.00	8.00	4.76	0.99	1.41	1.91	2.41	2.91	3.41	3.31	2.86	3.36	5.77	8.86	8.06	6.52	7.45
EXISTING	6.00	6.74	4.06	0.71	2.00	2.32	2.83	2.75	2.88	3.00	2.00	3.29	5.71	8.79	8.30	5.04	7.00
STATION	0+950	1+000	1+100	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+900	2+000	2+100	2+200	2+300	2+400	2+500

PROFILE

SCALE H 1:2000 V 1:200

H 20 m 0 1:2000 100 m

V 2 m 0 1:200 10 m

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

▬ ▬ ▬	FIRST NATION TREATY LAND BOUNDARY
──	EXISTING CREEK / STREAM
▬ ▬ ▬	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
─ ─ ─	EXISTING ROAD - UNIMPROVED
──	EXISTING ROAD
═══	PROPOSED ACCESS ROAD
– – – –	FINISHED GRADING TOE LINE
}─{	PROPOSED CULVERT

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CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE ACCESS ROAD
PLAN AND PROFILE - STA. 0+950 TO 2+500

D

PROJECT/DWG No.: 329510-CV-100-S0-0121

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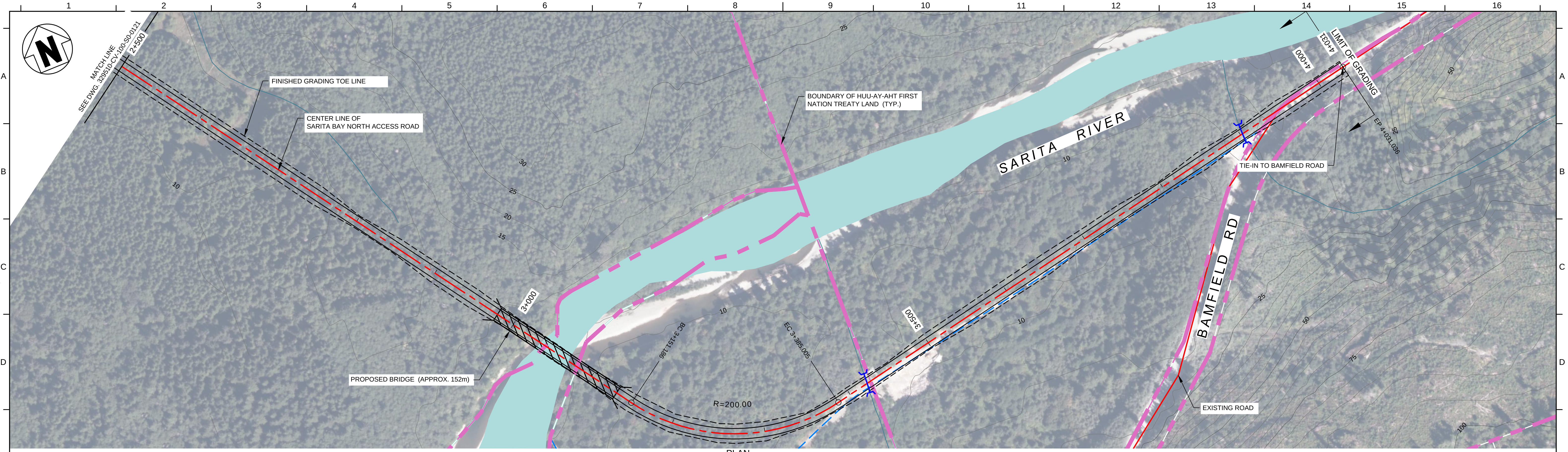

PLAN

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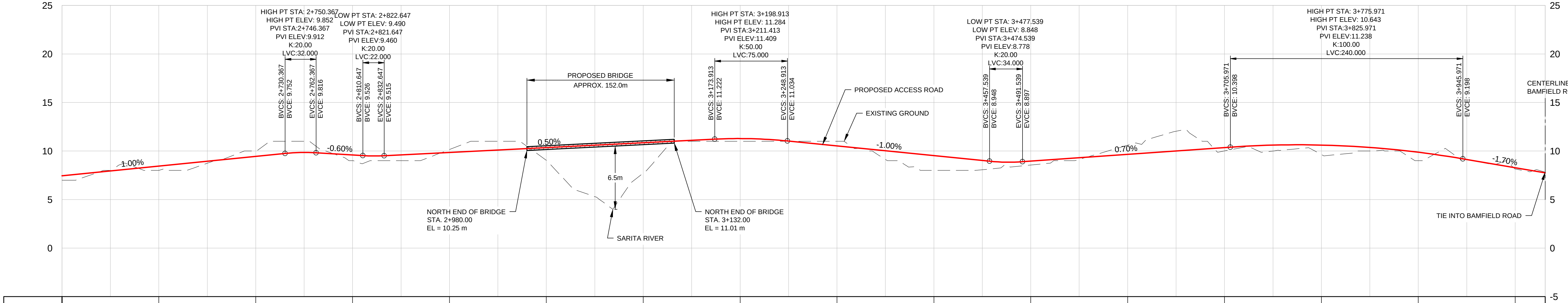

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EXISTING	7.00	8.00	10.00	9.00	10.16	9.04	7.72	11.00	11.00	8.00	8.56	10.59	10.01	9.64	9.00	8.15	7.82
STATION	2+500	2+600	2+700	2+800	2+900	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900	4+000	4+031

PROFILE

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H 20 m 0 1:2000 100 m
V 2 m 0 1:200 10 m

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

FIRST NATION TREATY LAND BOUNDARY
EXISTING CREEK / STREAM
POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
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EXISTING ROAD
PROPOSED ACCESS ROAD
FINISHED GRADING TOE LINE
PROPOSED CULVERT

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CLIENT:
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE ACCESS ROAD
PLAN AND PROFILE - STA. 2+500 TO 4+031

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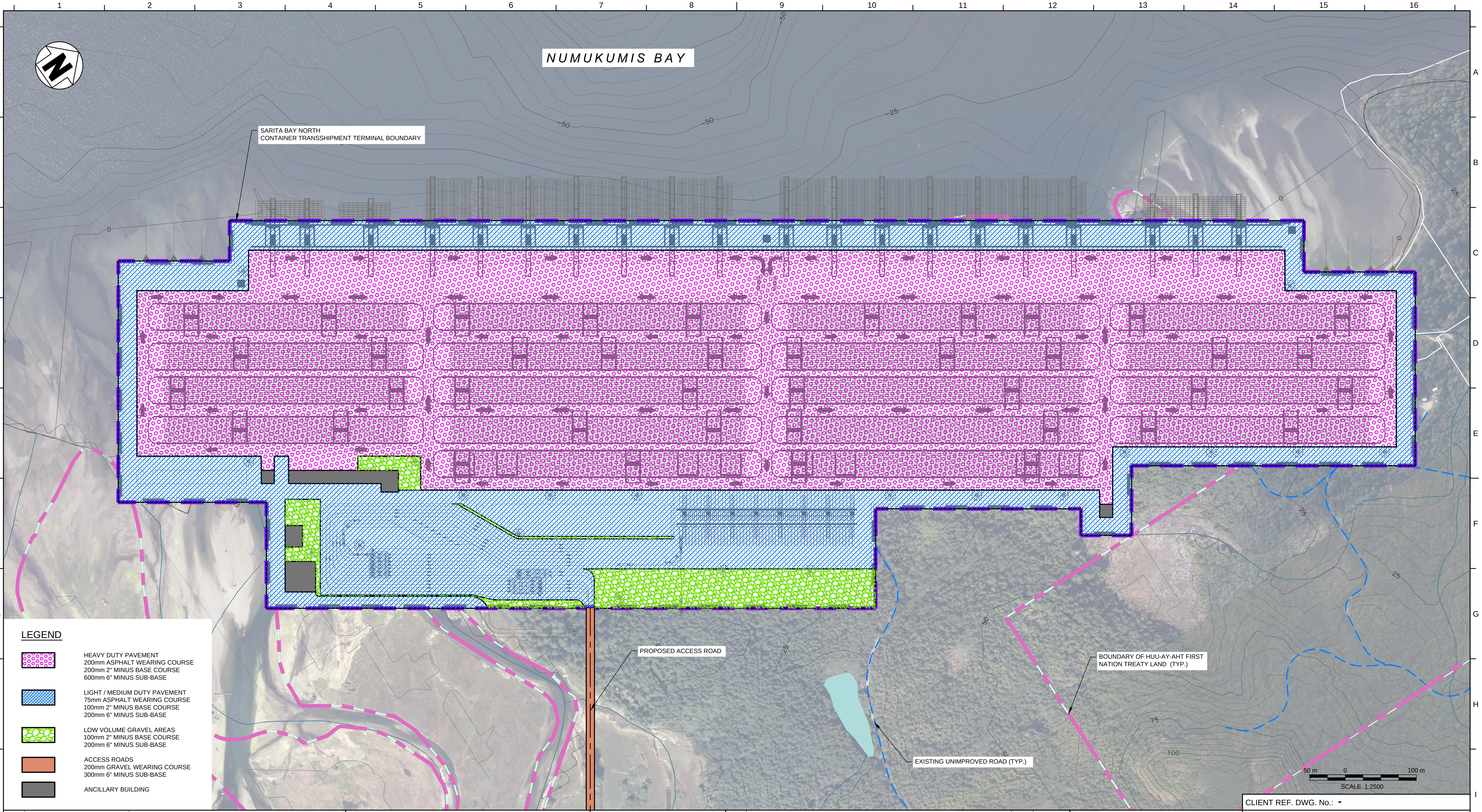
FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0130.dwg

USER NAME: Yu, Elizabeth

PLOT DATE: Friday, March 28, 2014 12:50:09 PM



LEGEND

▨	HEAVY DUTY PAVEMENT 200mm ASPHALT WEARING COURSE 200mm 2" MINUS BASE COURSE 600mm 6" MINUS SUB-BASE
▨	LIGHT / MEDIUM DUTY PAVEMENT 75mm ASPHALT WEARING COURSE 100mm 2" MINUS BASE COURSE 200mm 6" MINUS SUB-BASE
▨	LOW VOLUME GRAVEL AREAS 100mm 2" MINUS BASE COURSE 200mm 6" MINUS SUB-BASE
🟧	ACCESS ROADS 200mm GRAVEL WEARING COURSE 300mm 6" MINUS SUB-BASE
⬛	ANCILLARY BUILDING

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	AS		2014/03/28
CHECK:	MW		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

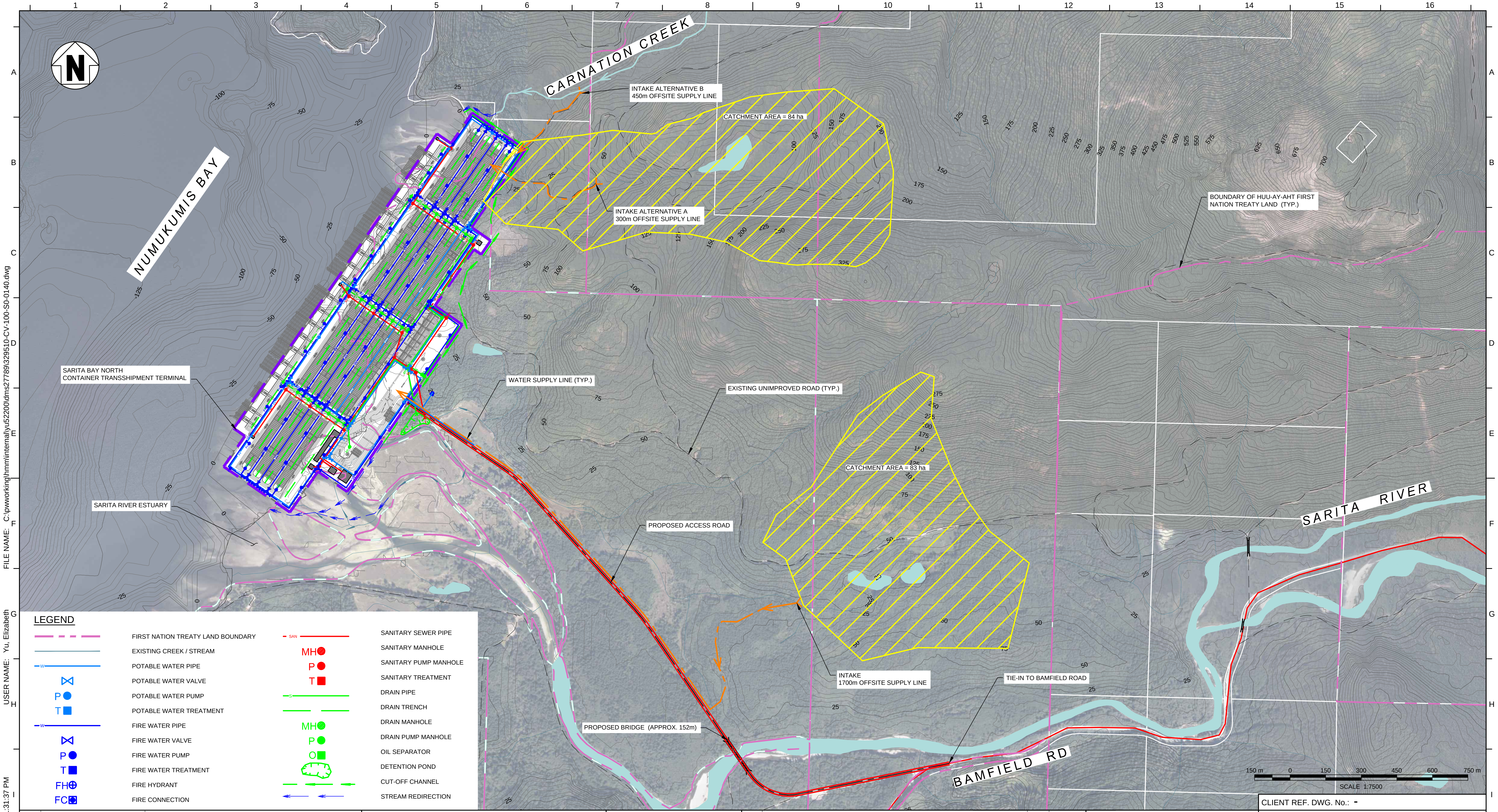
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
PAVING LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0130

REV No A



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USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 1:31:37 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	JN		2014/03/28
CHECK:	JN		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

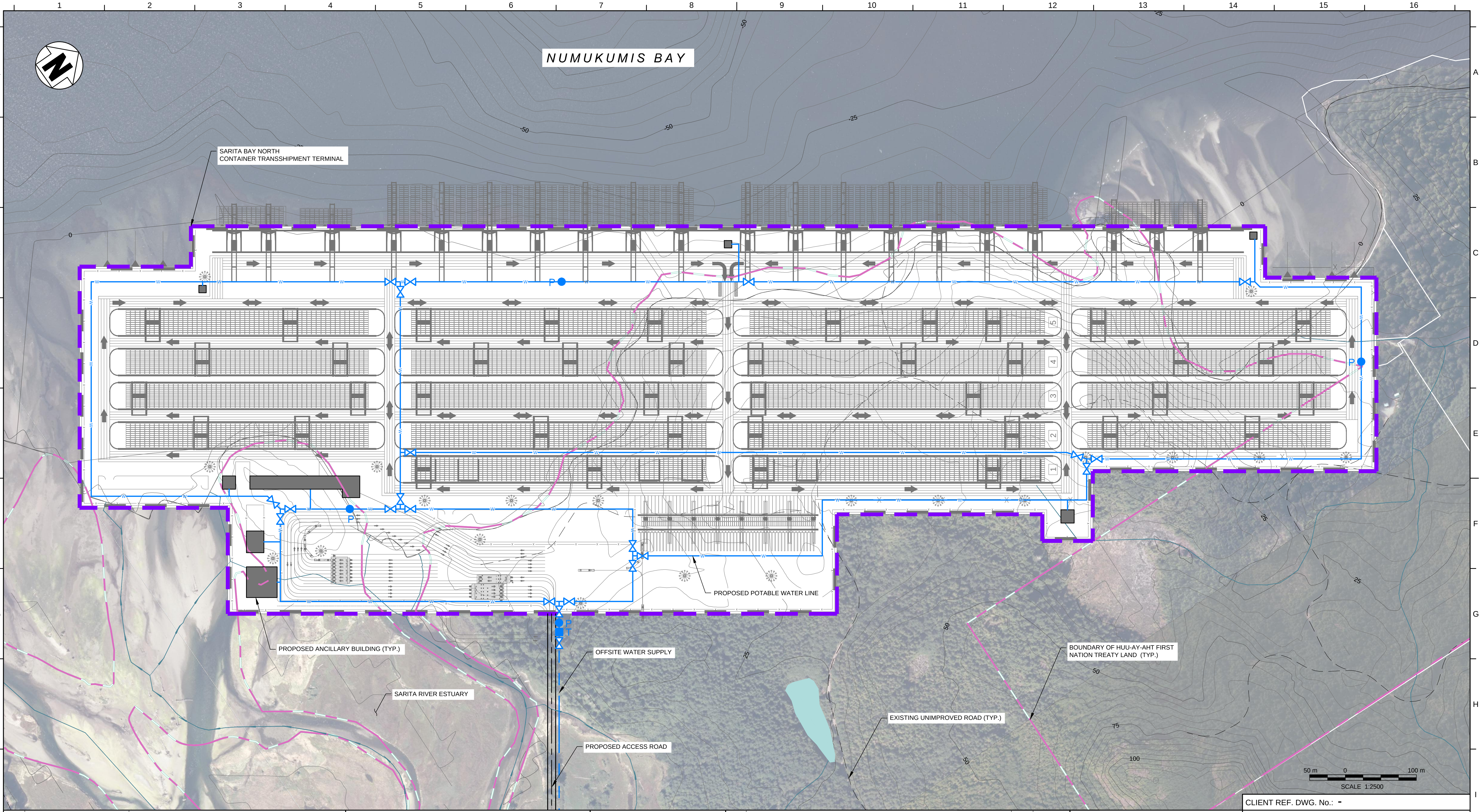
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
UTILITY OVERALL PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0140

REV No A



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USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 1:34:00 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

―	EXISTING CREEK / STREAM
–W―	POTABLE WATER PIPE
⋈	POTABLE WATER VALVE
P ●	POTABLE WATER PUMP
T ■	POTABLE WATER TREATMENT

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	JN		2014/03/28
CHECK:	JN		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

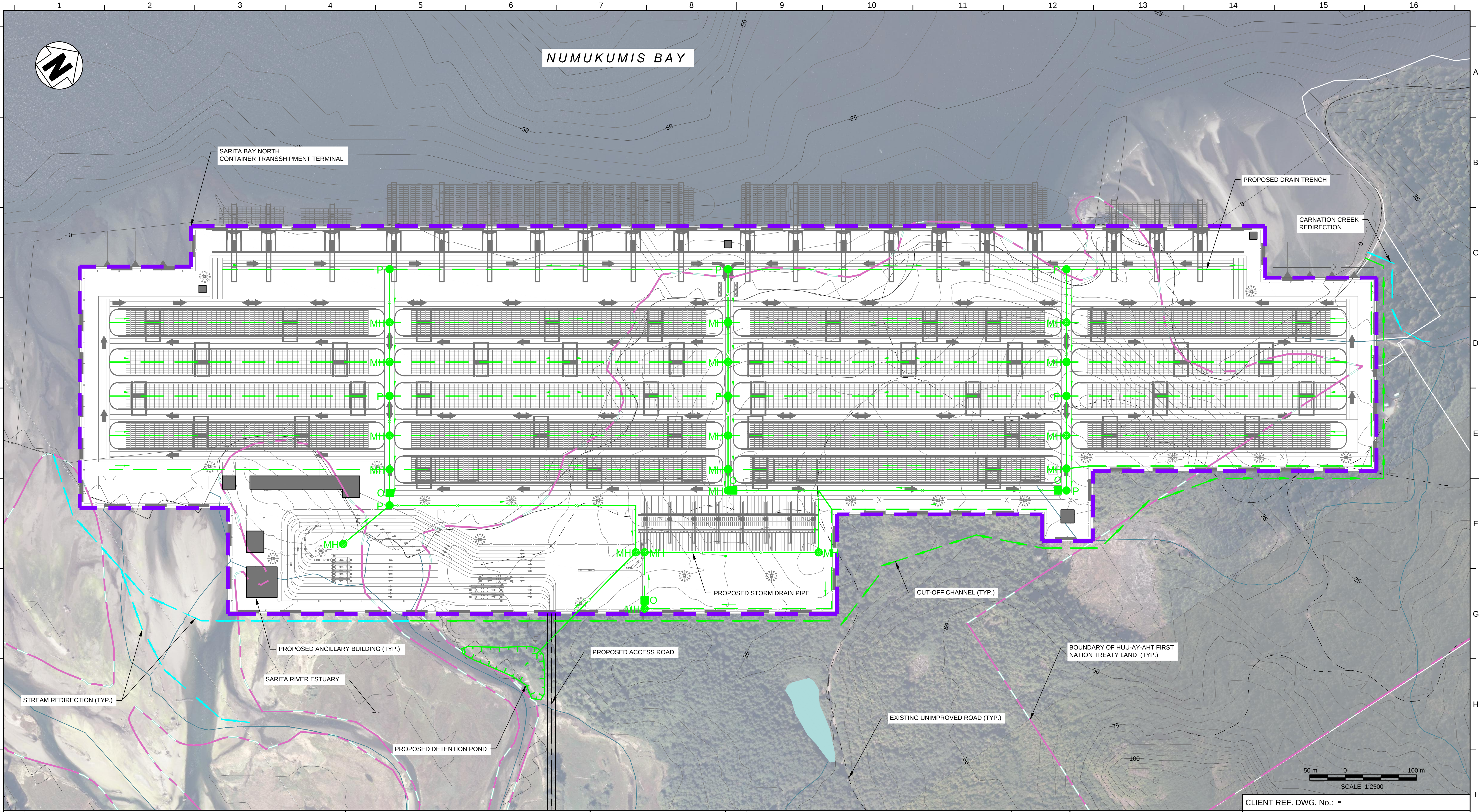
PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
POTABLE WATER LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0141

REV No A

PLOT DATE: Thursday, March 27, 2014 5:22:26 PM
USER NAME: Yu, Elizabeth
FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0142.dwg



REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

—	EXISTING CREEK / STREAM
—S—	DRAIN PIPE
— —	DRAIN TRENCH
MH●	DRAIN MANHOLE
P●	DRAIN PUMP MANHOLE
O■	OIL SEPARATOR
→	DRAINAGE FLOW
	DETENTION POND

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	JN		2014/03/28
CHECK:	JN		2014/03/28
REVIEW:	HW		2014/03/28

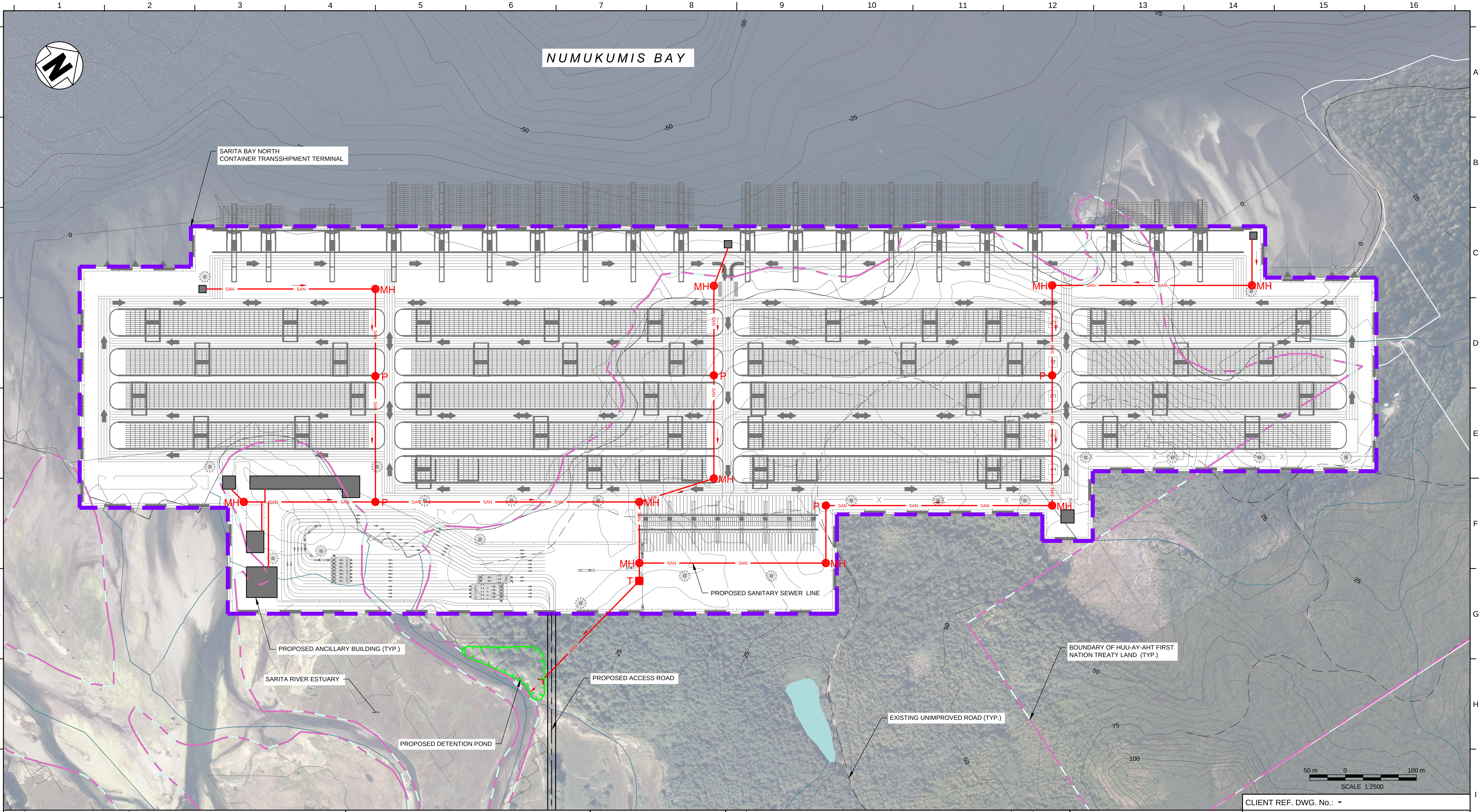
SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
SITE DRAINAGE LAYOUT PLAN

D
PROJECT/DWG No.: 329510-CV-100-S0-0142
REV No A



REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

This document is issued for the party which commissioned it and for specific purposes connected with the captioned project only. It should not be relied upon by any other party or used for any other purpose. We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties. This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

LEGEND

—	EXISTING CREEK / STREAM
— SAN —	SANITARY SEWER PIPE
MH ●	SANITARY MANHOLE
P ●	SANITARY PUMP MANHOLE
T ■	SANITARY TREATMENT
→	SANITARY FLOW
⬭	DETENTION POND

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	JN		2014/03/28
CHECK:	JN		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

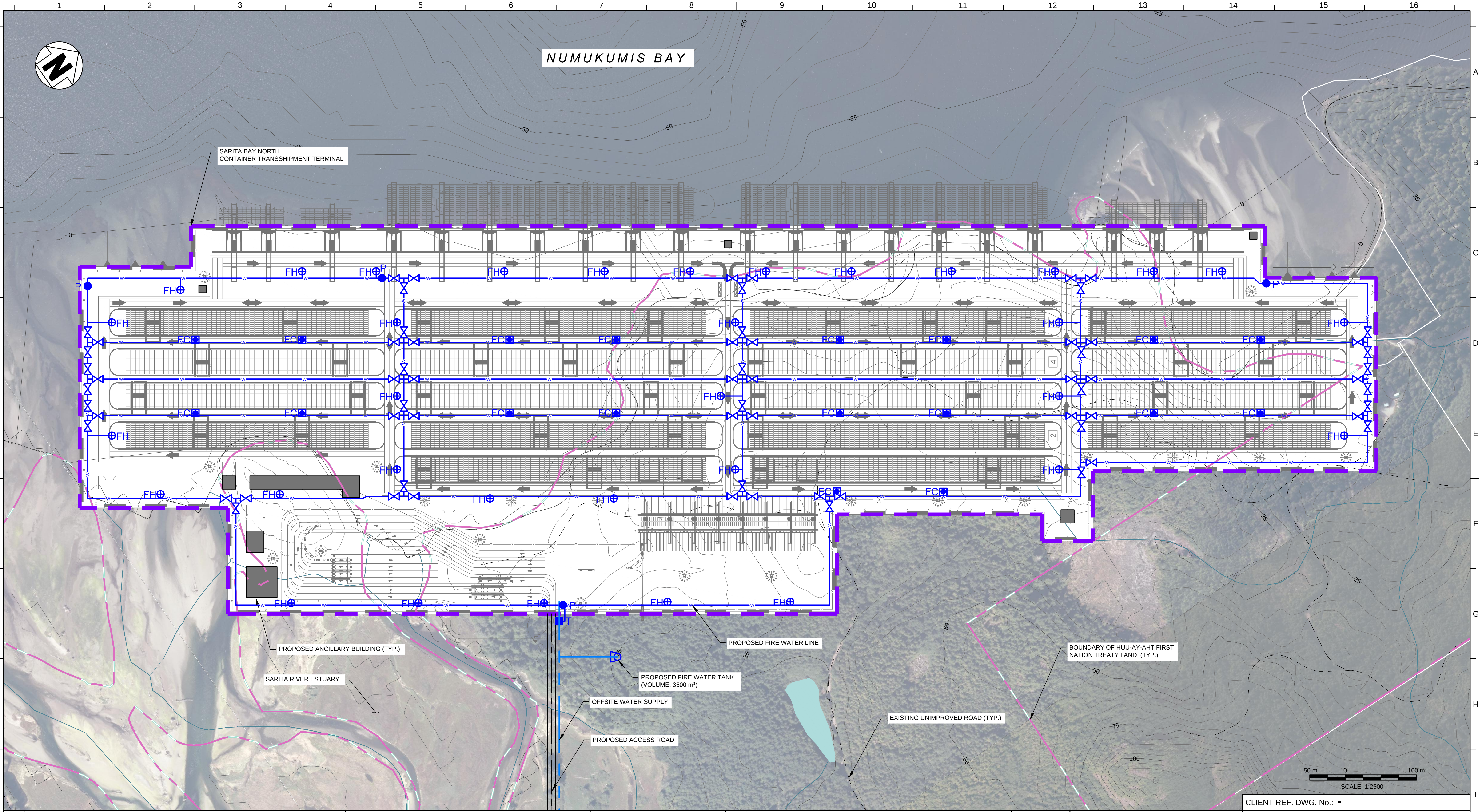
CLIENT REF. DWG. No.: -

CLIENT:
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
SANITARY SEWER LAYOUT PLAN

D
PROJECT/DWG No.: 329510-CV-100-S0-0143
REV No A

PLOT DATE: Thursday, March 27, 2014 6:11:06 PM
USER NAME: Yu, Elizabeth
FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0143.dwg



NUMUKUMIS BAY

SARITA BAY NORTH
CONTAINER TRANSSHIPMENT TERMINAL

PROPOSED ANCILLARY BUILDING (TYP.)

SARITA RIVER ESTUARY

PROPOSED FIRE WATER LINE

PROPOSED FIRE WATER TANK
(VOLUME: 3500 m³)

OFFSITE WATER SUPPLY

PROPOSED ACCESS ROAD

BOUNDARY OF HUU-AY-AHT FIRST
NATION TREATY LAND (TYP.)

EXISTING UNIMPROVED ROAD (TYP.)

SCALE 1:2500

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0144.dwg

USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 1:40:14 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

—	EXISTING CREEK / STREAM
—W—	FIRE WATER PIPE
⋈	FIRE WATER VALVE
P●	FIRE WATER PUMP
T■	FIRE WATER TREATMENT
FH⊕	FIRE HYDRANT
FC▣	FIRE CONNECTION

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	JN		2014/03/28
CHECK:	JN		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

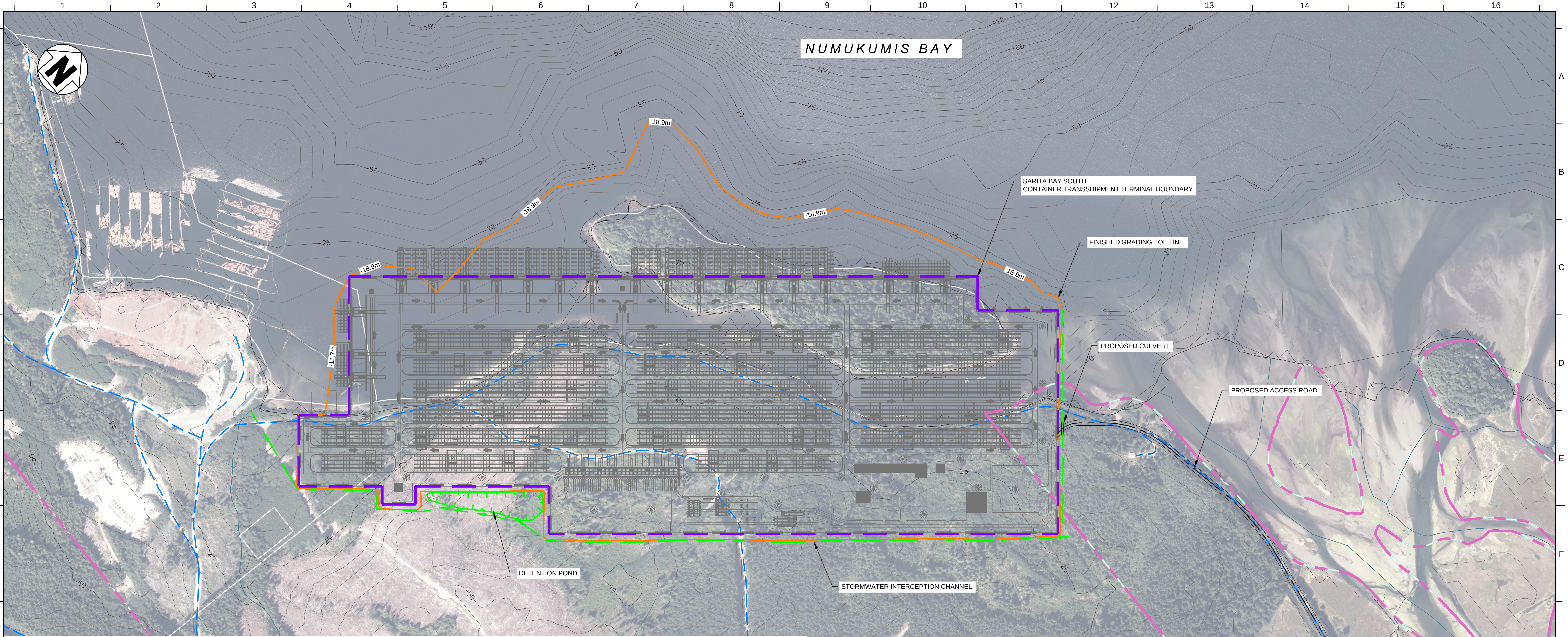
CLIENT:
Port Alberni
Port Authority

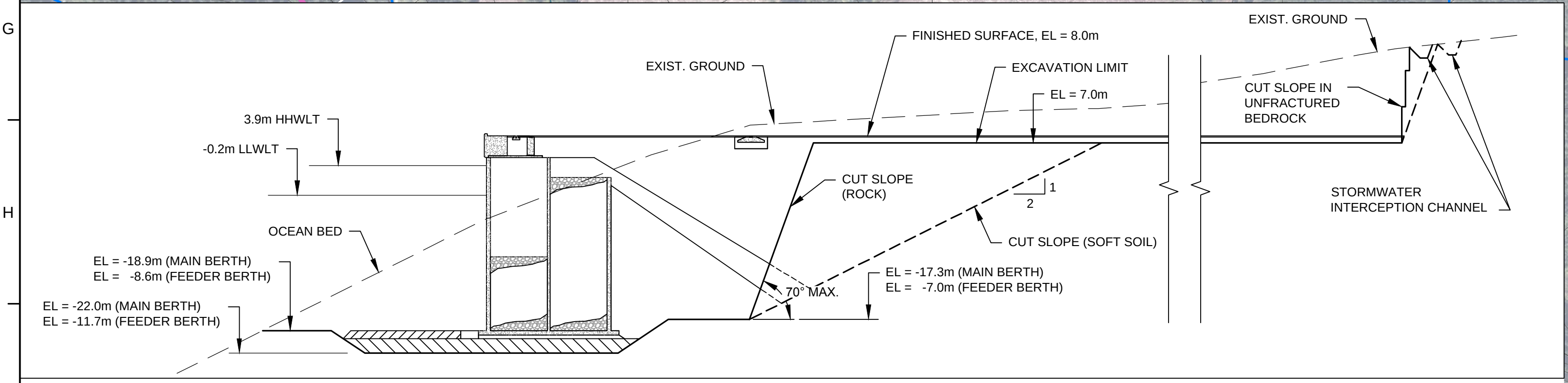
PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH SITE
FIRE WATER LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0144

REV No A





TYPICAL CROSS- SECTION
SCALE 1:500

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0210.dwg

USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 12:27:16 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

- FIRST NATION TREATY LAND BOUNDARY
- EXISTING CREEK / STREAM
- POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
- EXISTING ROAD - UNIMPROVED
- EXISTING ROAD
- PROPOSED ACCESS ROAD
- FINISHED GRADING TOE LINE

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	EY		2014/03/28
CHECK:	AS		2014/03/28
REVIEW:	HW		2014/03/28

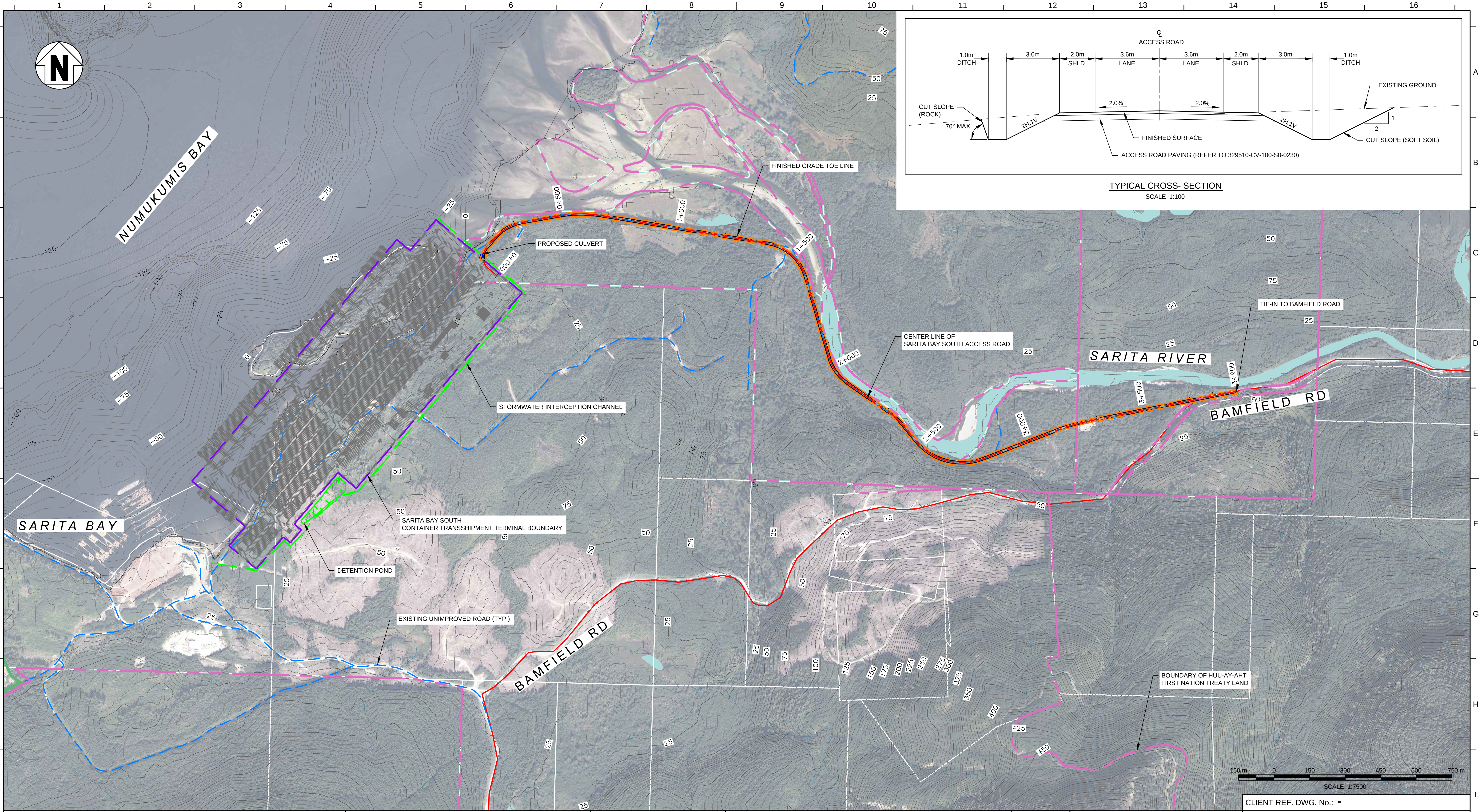
SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT:
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
GRADING PLAN

D
PROJECT/DWG No.: 329510-CV-100-S0-0210
REV No A



FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0220.dwg

USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 3:40:23 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

▬ ▪ ▬	FIRST NATION TREATY LAND BOUNDARY
──	EXISTING CREEK / STREAM
▬ ▬ ▬	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
– – –	EXISTING ROAD - UNIMPROVED
──	EXISTING ROAD
═	PROPOSED ACCESS ROAD
──	FINISHED GRADING TOE LINE

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	EY		2014/03/28
CHECK:	AS		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
ACCESS ROAD OVERALL PLAN

D

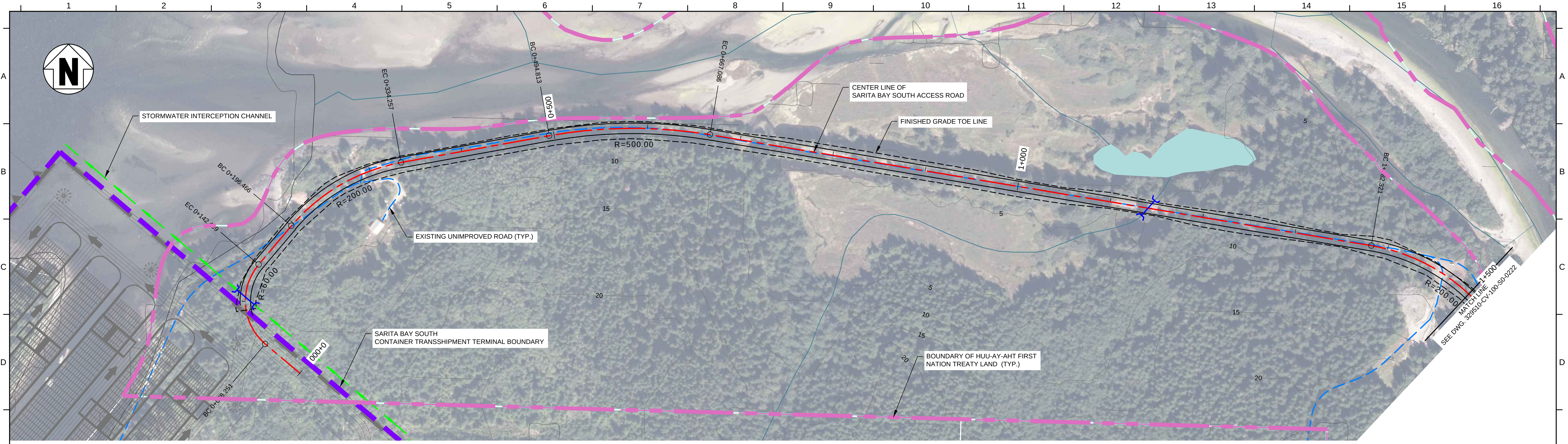
PROJECT/DWG No.: 329510-CV-100-S0-0220

REV No A

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0221.dwg

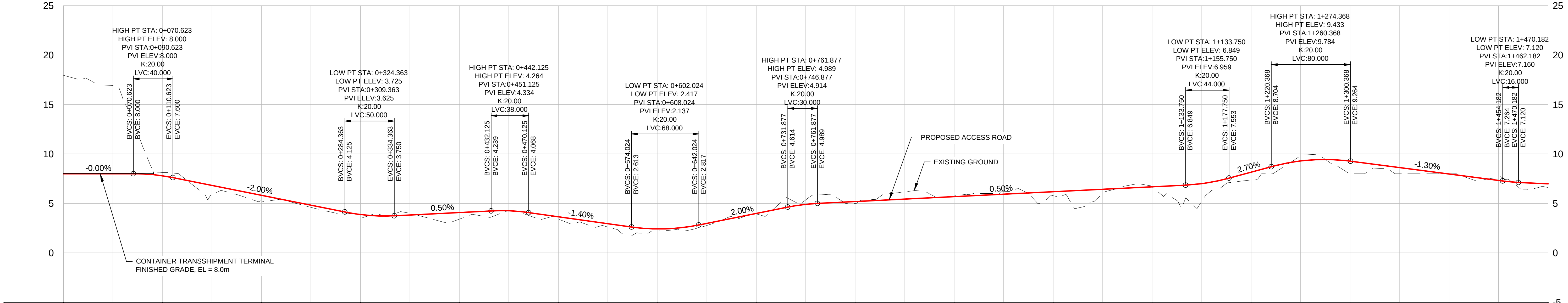
USER NAME: Yu, Elizabeth

PLOT DATE: Tuesday, April 08, 2014 8:18:46 AM



PLAN

SCALE 1:2000



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0+000	8.00	17.95
0+100	7.78	8.11
0+200	5.81	5.25
0+300	3.87	3.69
0+400	4.08	3.41
0+500	3.65	3.41
0+600	2.42	2.20
0+700	3.98	3.94
0+800	5.18	5.00
0+900	5.68	5.76
1+000	6.18	5.78
1+100	6.68	6.66
1+200	8.15	7.37
1+300	9.27	8.00
1+400	7.97	8.00
1+500	6.97	6.60

PROFILE

SCALE H 1:2000 V 1:200

H 20 m 0 1:2000 100 m

V 2 m 0 1:200 10 m

REFERENCE DRAWINGS

REF.	DRAWING NUMBER	DRAWING TITLE

LEGEND

— · —	FIRST NATION TREATY LAND BOUNDARY
—	EXISTING CREEK / STREAM
— —	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
— —	EXISTING ROAD - UNIMPROVED
—	EXISTING ROAD
═	PROPOSED ACCESS ROAD
- - - -	FINISHED GRADING TOE LINE
⊢⊣	PROPOSED CULVERT

ENGINEER STAMP:

REVISIONS

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/04/17

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/04/17
DESIGN:	EY		2014/04/17
CHECK:	AS		2014/04/17
REVIEW:	TH		2014/04/17

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

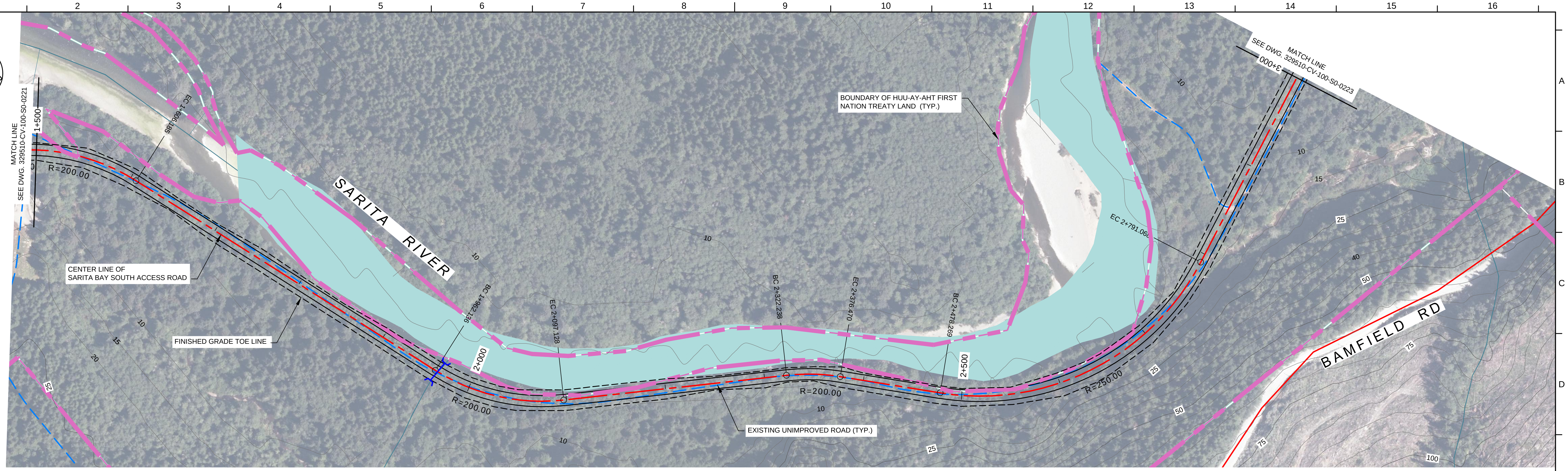
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE ACCESS ROAD
PLAN AND PROFILE - STA. 0+000 TO 1+500

D

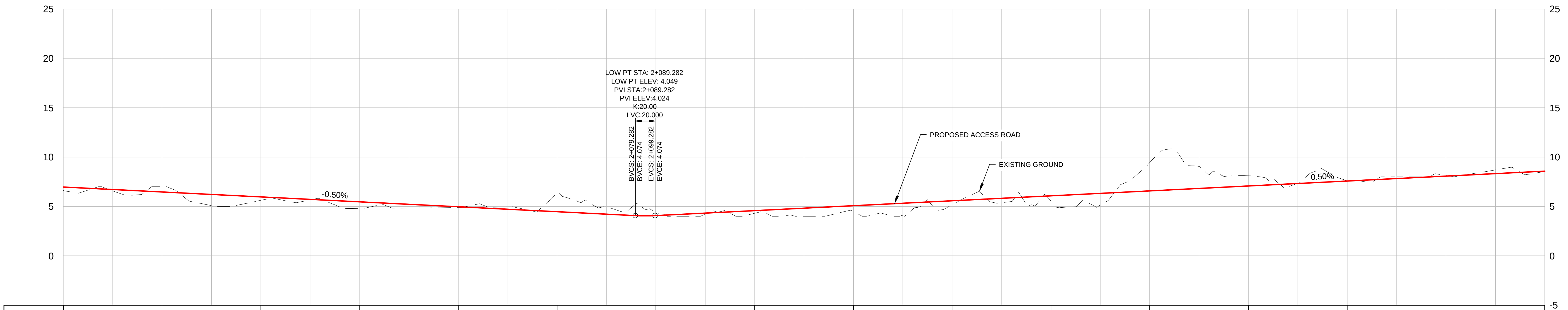
PROJECT/DWG No.: 329510-CV-100-S0-0221

REV No A



PLAN

SCALE 1:2000



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EXISTING	6.60	7.00	5.62	4.79	4.88	6.41	4.42	4.31	4.50	5.17	5.56	9.44	8.11	7.60	8.13	8.53
STATION	1+500	1+600	1+700	1+800	1+900	2+000	2+100	2+200	2+300	2+400	2+500	2+600	2+700	2+800	2+900	3+000

PROFILE

SCALE H 1:2000 V 1:200

H 20 m 0 1:2000 100 m

V 2 m 0 1:200 10 m

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

▬ ▬ ▬	FIRST NATION TREATY LAND BOUNDARY
──	EXISTING CREEK / STREAM
▬ ▬ ▬	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
─ ─ ─	EXISTING ROAD - UNIMPROVED
──	EXISTING ROAD
═══	PROPOSED ACCESS ROAD
- - - -	FINISHED GRADING TOE LINE
}─{	PROPOSED CULVERT

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/04/17

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/04/17
DESIGN:	EY		2014/04/17
CHECK:	AS		2014/04/17
REVIEW:	TH		2014/04/17

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE ACCESS ROAD
PLAN AND PROFILE - STA. 1+500 TO 3+000

D PROJECT/DWG No.: 329510-CV-100-S0-0222 REV No A

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0221.dwg

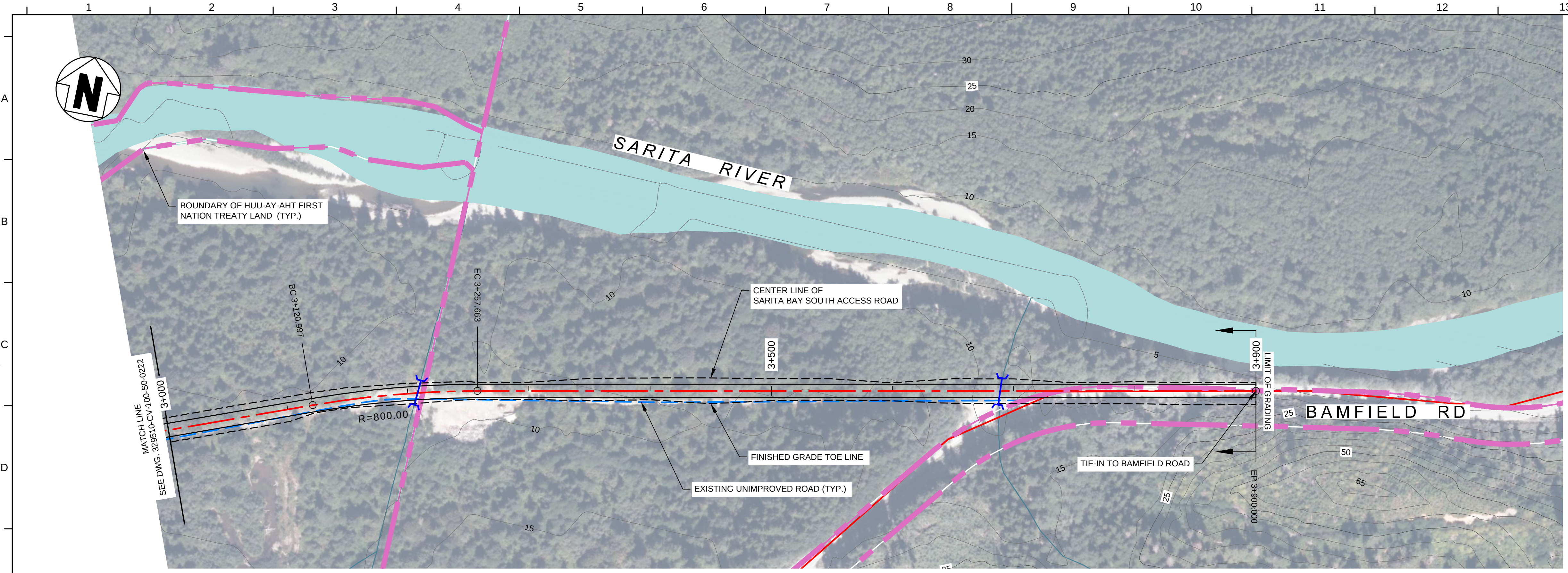
USER NAME: Yu, Elizabeth

PLOT DATE: Tuesday, April 08, 2014 8:22:14 AM

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0221.dwg

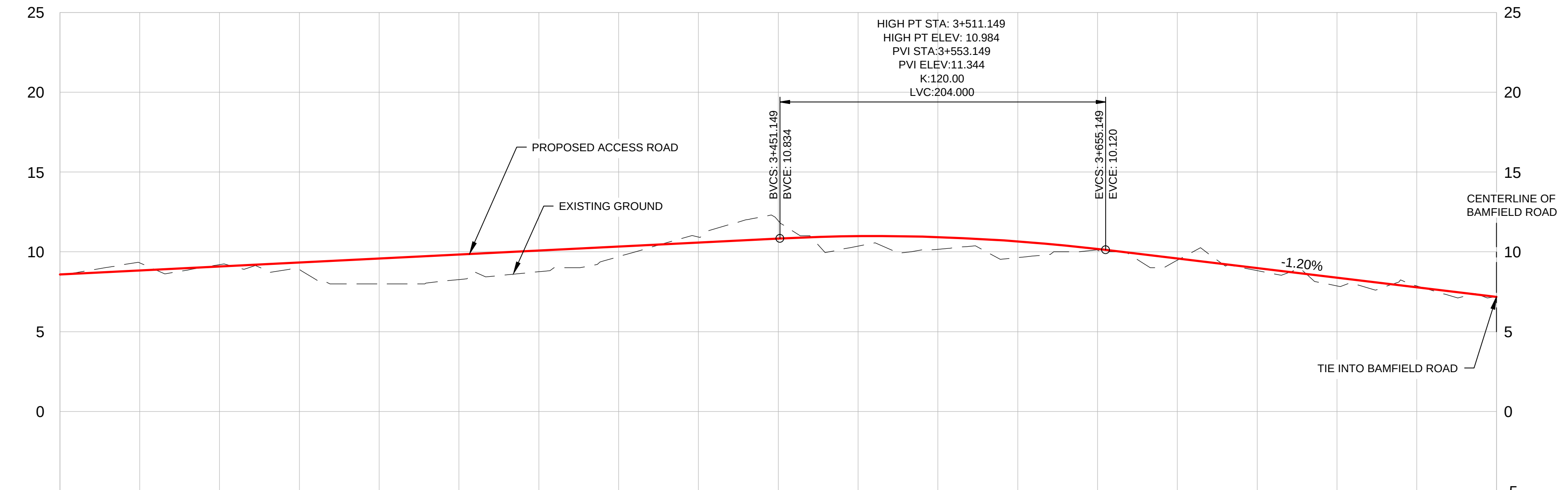
USER NAME: Yu, Elizabeth

PLOT DATE: Tuesday, April 08, 2014 8:31:54 AM



PLAN

SCALE 1:2000



	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900
PROPOSED	8.58	9.08	9.58	10.08	10.58	10.98	10.65	9.58	8.38	7.18
EXISTING	8.53	9.19	8.00	8.75	10.93	10.36	9.64	9.47	7.87	7.19

STATION

PROFILE

SCALE H 1:2000 V 1:200

H 20 m 0 1:2000 100 m

V 2 m 0 1:200 10 m

REFERENCE DRAWINGS

REF.	DRAWING NUMBER	DRAWING TITLE

LEGEND

▬ ▬	FIRST NATION TREATY LAND BOUNDARY
—	EXISTING CREEK / STREAM
▬ ▬	POTENTIAL TRANSSHIPMENT TERMINAL BOUNDARY
— —	EXISTING ROAD - UNIMPROVED
—	EXISTING ROAD
═	PROPOSED ACCESS ROAD
- - -	FINISHED GRADING TOE LINE
}—{	PROPOSED CULVERT

ENGINEER STAMP:

REVISIONS

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/04/17

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/04/17
DESIGN:	EY		2014/04/17
CHECK:	AS		2014/04/17
REVIEW:	TH		2014/04/17

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

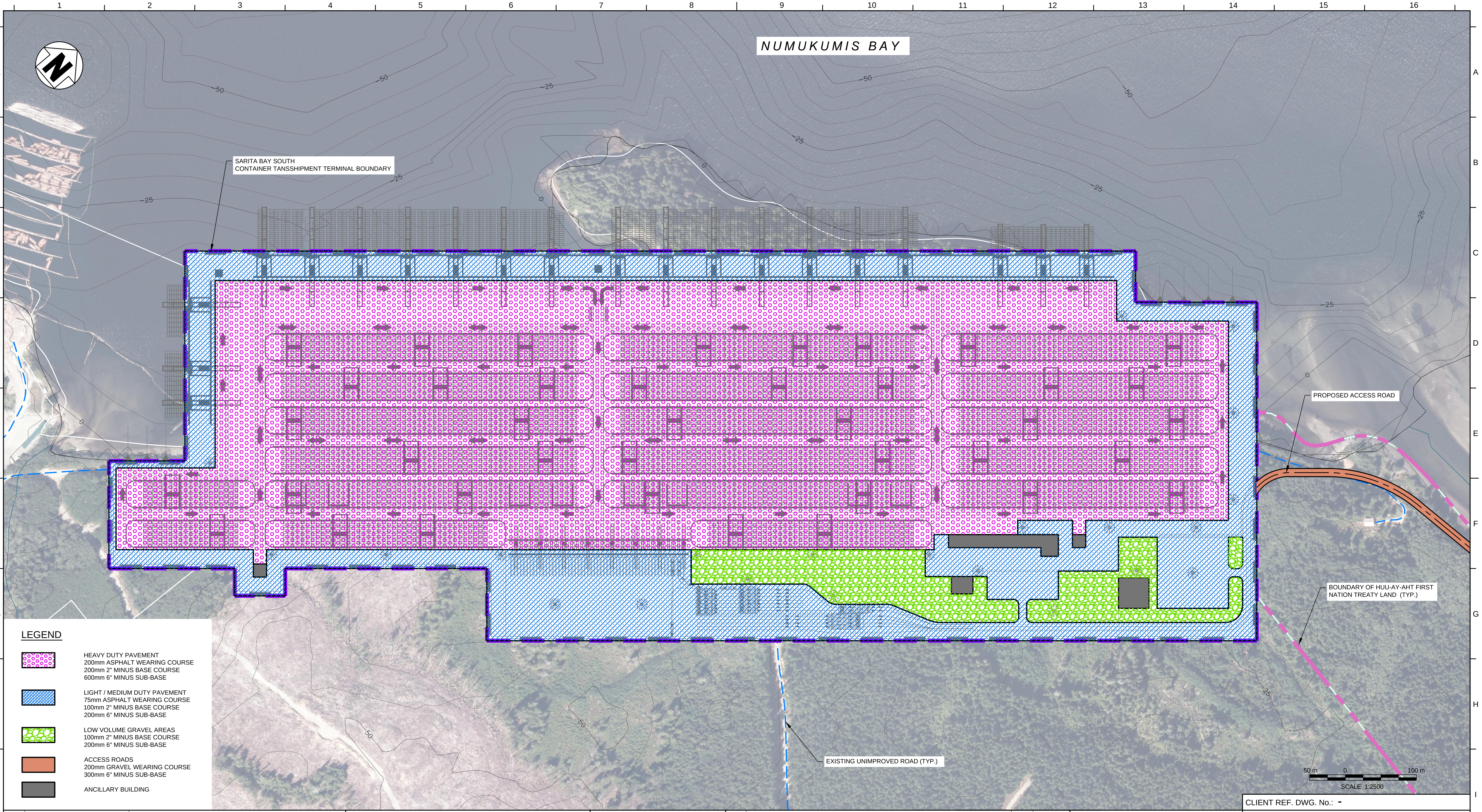
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE ACCESS ROAD
PLAN AND PROFILE - STA. 3+000 TO 3+900

D

PROJECT/DWG No.: 329510-CV-100-S0-0223

REV No A



LEGEND

▨	HEAVY DUTY PAVEMENT 200mm ASPHALT WEARING COURSE 200mm 2" MINUS BASE COURSE 600mm 6" MINUS SUB-BASE
▨	LIGHT / MEDIUM DUTY PAVEMENT 75mm ASPHALT WEARING COURSE 100mm 2" MINUS BASE COURSE 200mm 6" MINUS SUB-BASE
▨	LOW VOLUME GRAVEL AREAS 100mm 2" MINUS BASE COURSE 200mm 6" MINUS SUB-BASE
■	ACCESS ROADS 200mm GRAVEL WEARING COURSE 300mm 6" MINUS SUB-BASE
■	ANCILLARY BUILDING

FILE NAME: C:\pwworking\hmm\internal\yu52200\dms27789\329510-CV-100-S0-0230.dwg

USER NAME: Yu, Elizabeth

PLOT DATE: Friday, March 28, 2014 12:38:34 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	AS	2014/03/28

REVISIONS

Hatch Mott MacDonald

	INITIALS	SIGNATURE	YYYY/MM/DD
DRAWN:	EY		2014/03/28
DESIGN:	AS		2014/03/28
CHECK:	MW		2014/03/28
REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

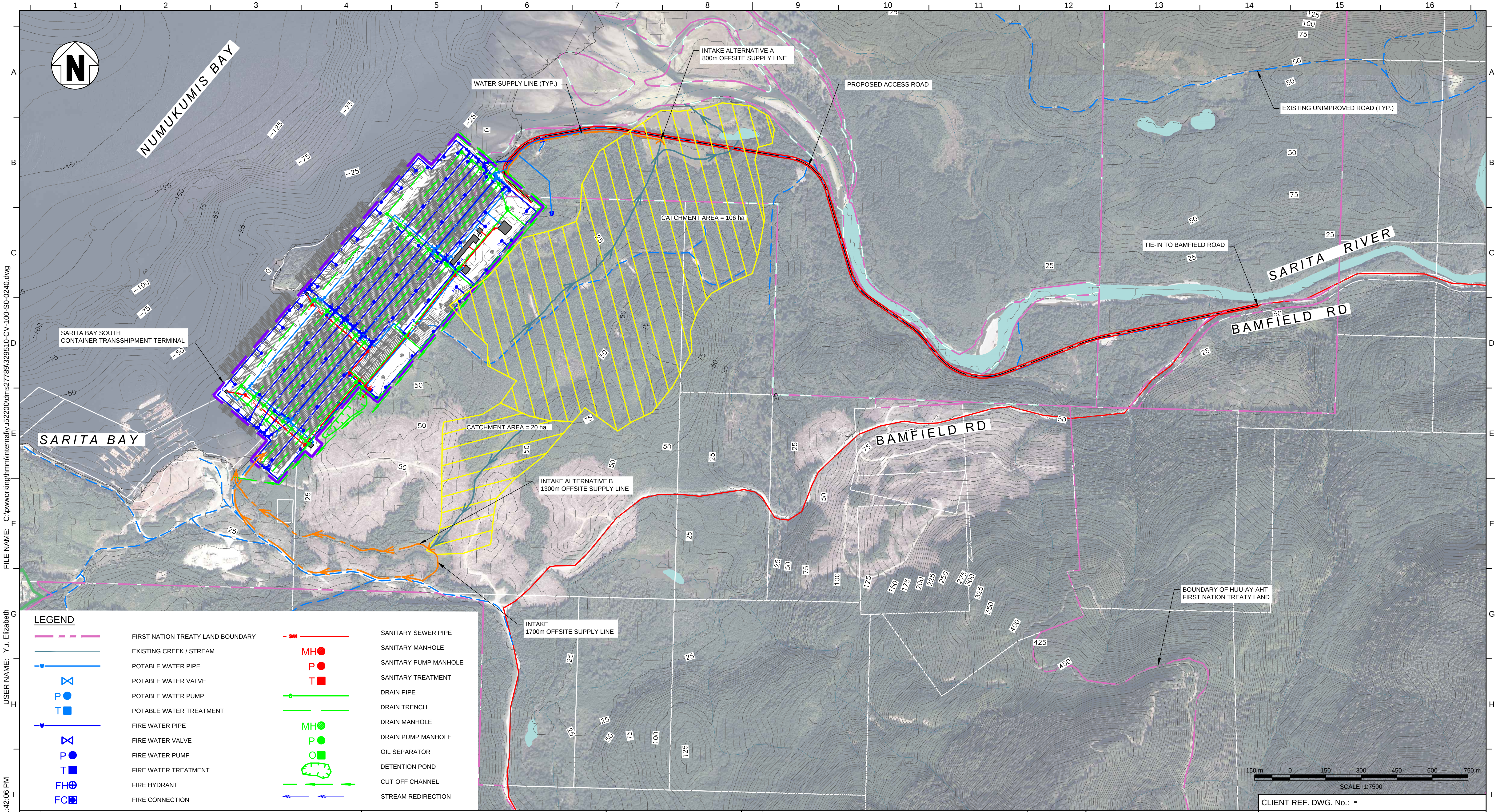
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
PAVING LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0230

REV No A



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USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 1:42:06 PM

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REVISIONS

Hatch Mott MacDonald

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

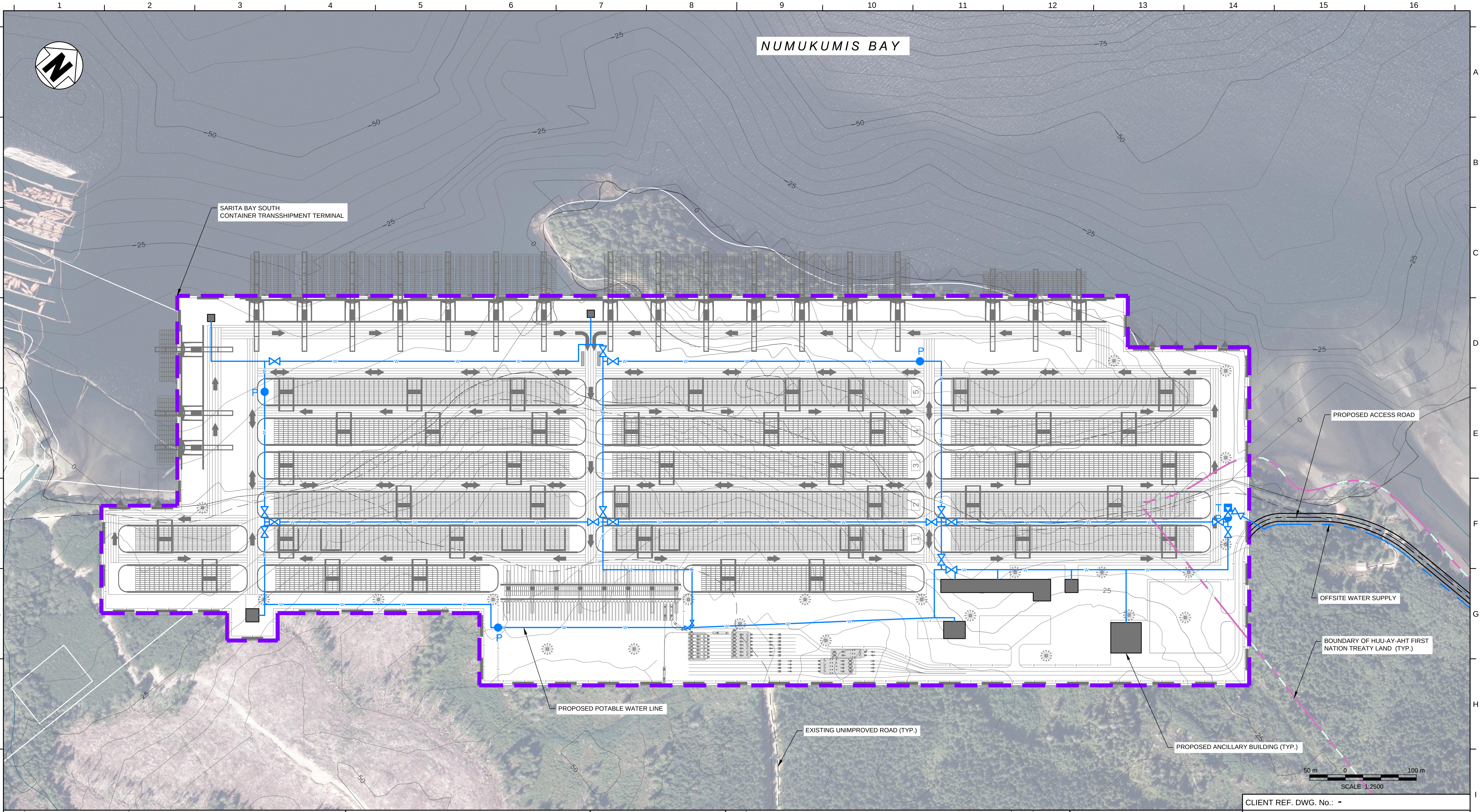
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
OVERALL UTILITY PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0240

REV No A



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PLOT DATE: Thursday, March 27, 2014 6:21:11 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

───	EXISTING CREEK / STREAM
─W───	PROPOSED POTABLE WATER PIPE
⋈	PROPOSED WATER VALVE
P ●	PROPOSED WATER PUMP
T ■	PROPOSED WATER TREATMENT

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
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REVISIONS

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

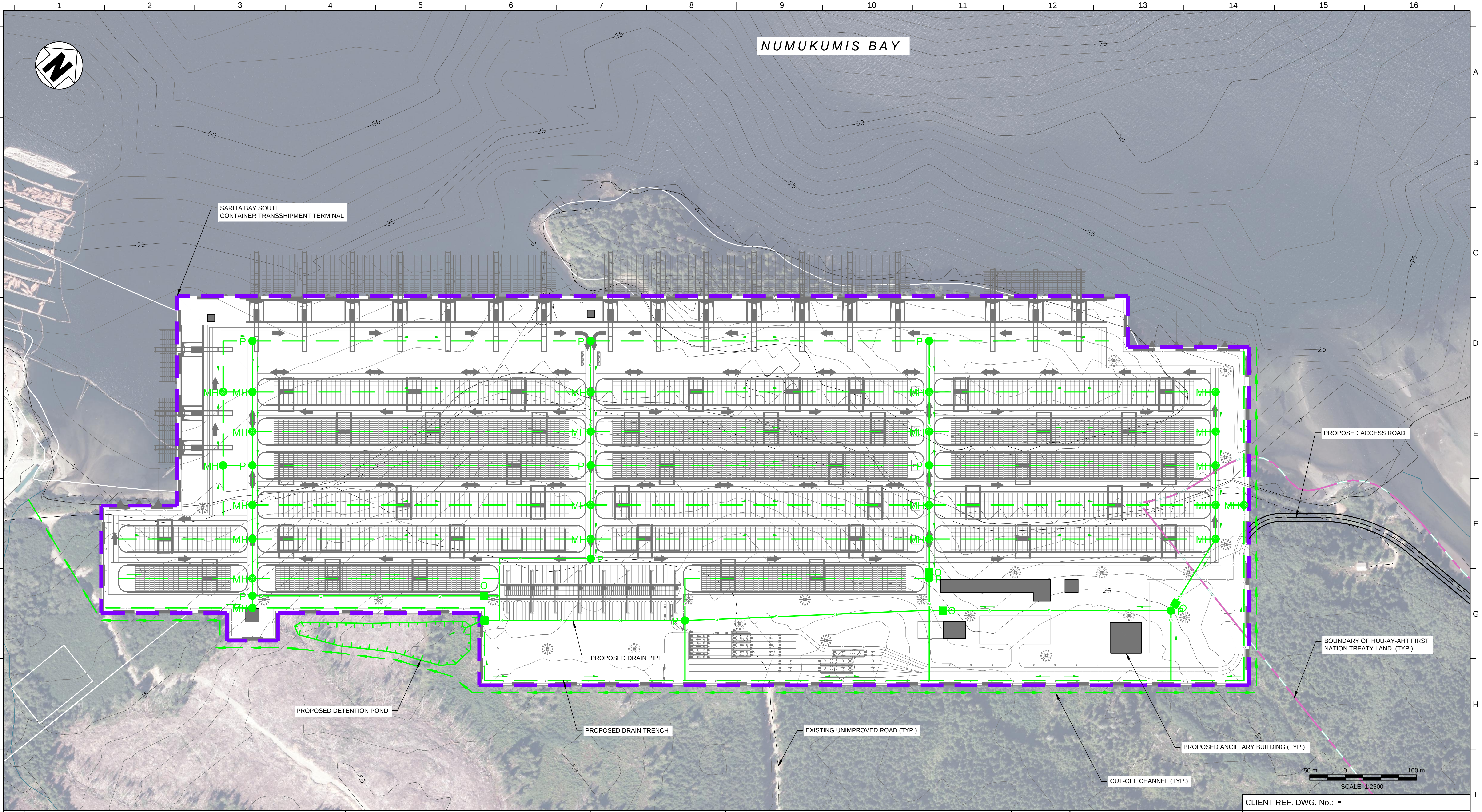
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
POTABLE WATER LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0241

REV No: A



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USER NAME: Yu, Elizabeth

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REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

───	EXISTING CREEK / STREAM
──●──	DRAIN PIPE
── ──	DRAIN TRENCH
MH●	DRAIN MANHOLE
P●	DRAIN PUMP MANHOLE
O■	OIL SEPARATOR
→	DRAINAGE FLOW
⬭	DETENTION POND

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
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REVISIONS

Hatch Mott MacDonald

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REVIEW:	HW		2014/03/28

SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
SITE DRAINAGE LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0242

REV No A

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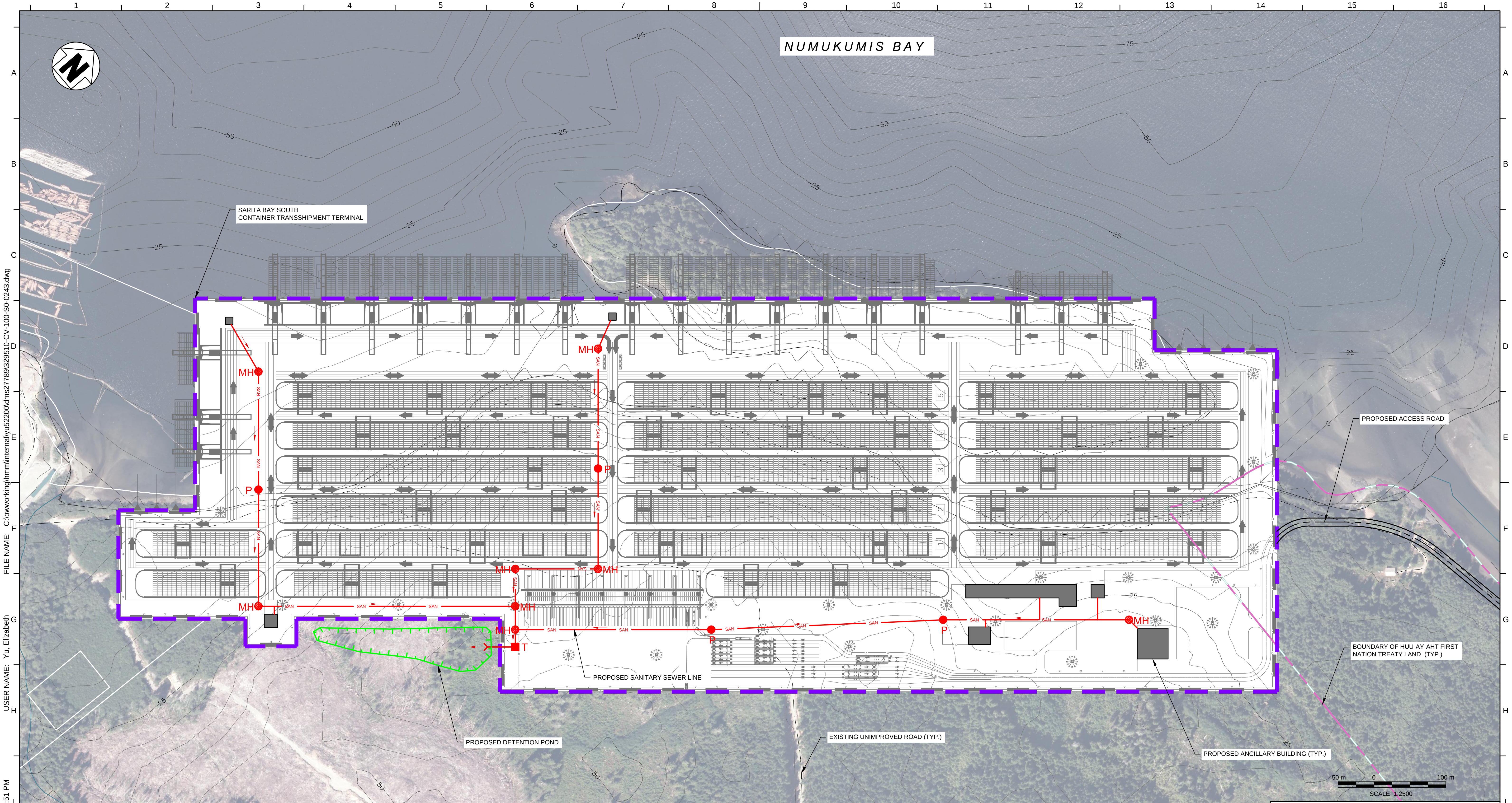

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LEGEND

―	EXISTING CREEK / STREAM
- SAN ―	SANITARY SEWER PIPE
MH●	SANITARY MANHOLE
P●	SANITARY PUMP MANHOLE
T■	SANITARY TREATMENT
→	SANITARY FLOW
	DETENTION POND

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
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REVISIONS

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

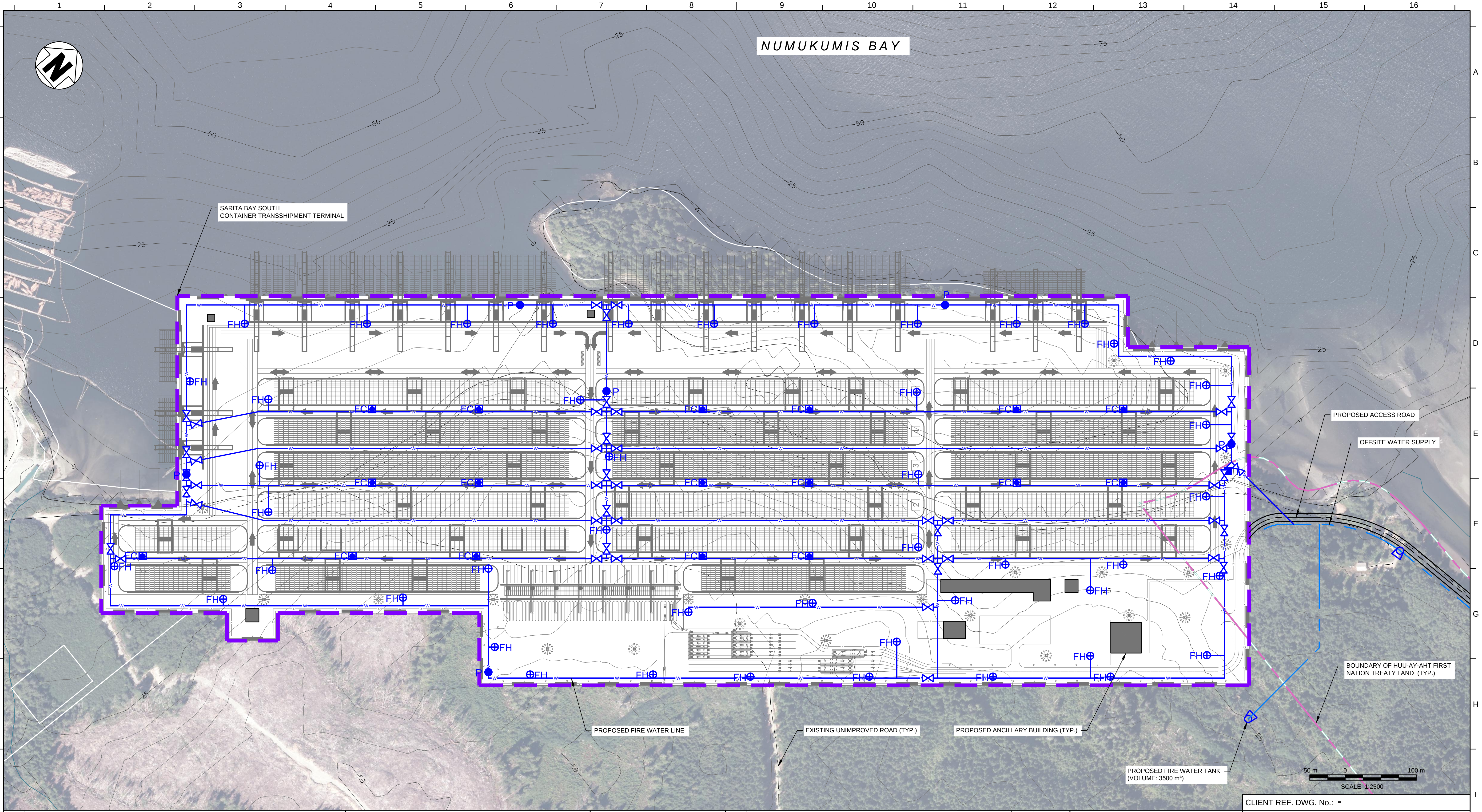
CLIENT:
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
SANITARY SEWER LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0243

REV No: A



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USER NAME: Yu, Elizabeth

PLOT DATE: Monday, March 31, 2014 1:45:43 PM

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

LEGEND

──	EXISTING CREEK / STREAM
─w─	FIRE WATER PIPE
⋈	FIRE WATER VALVE
P●	FIRE WATER PUMP
T■	FIRE WATER TREATMENT
FH⊕	FIRE HYDRANT
FC⊡	FIRE CONNECTION

ENGINEER STAMP:

NO.	DESCRIPTION	BY	YYYY/MM/DD
A	ISSUED FOR CLIENT REVIEW	HW	2014/03/28

REVISIONS

Hatch Mott MacDonald

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT:

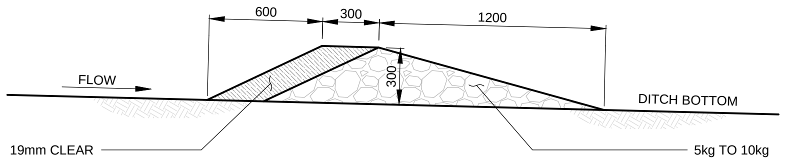
Port Alberni
Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY SOUTH SITE
FIRE WATER LAYOUT PLAN

D

PROJECT/DWG No.: 329510-CV-100-S0-0244

REV No A



SECTION A
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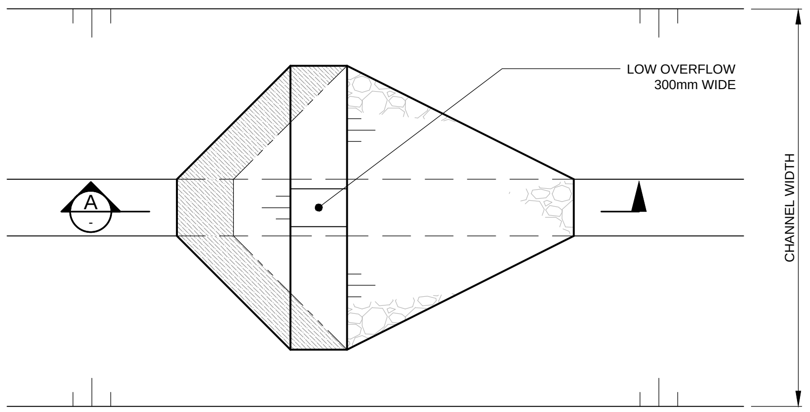

ROCK CHECK BERM
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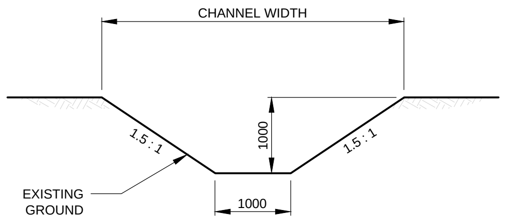

NATURAL WATER INTERCEPTOR DETAIL
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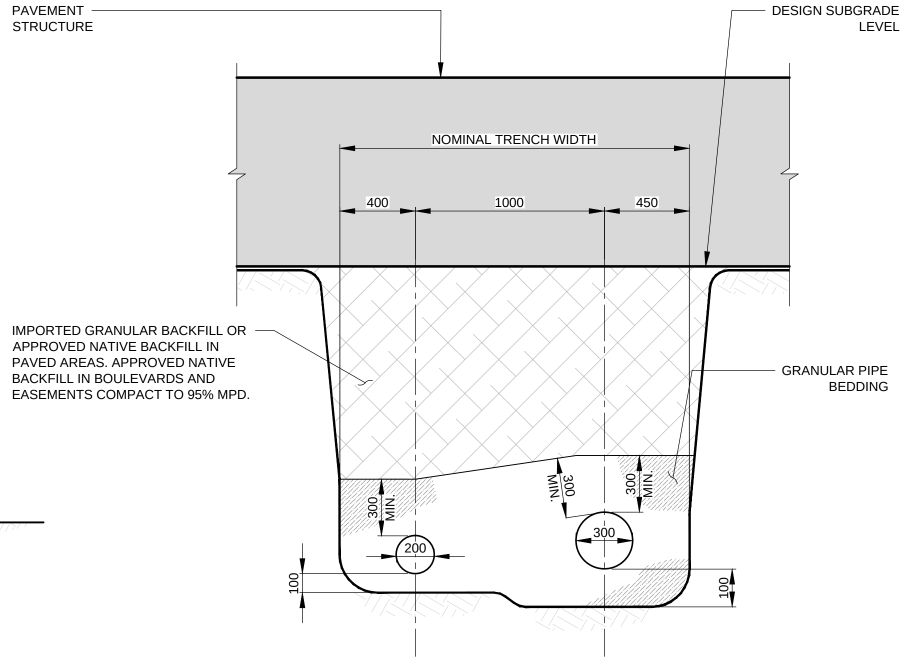
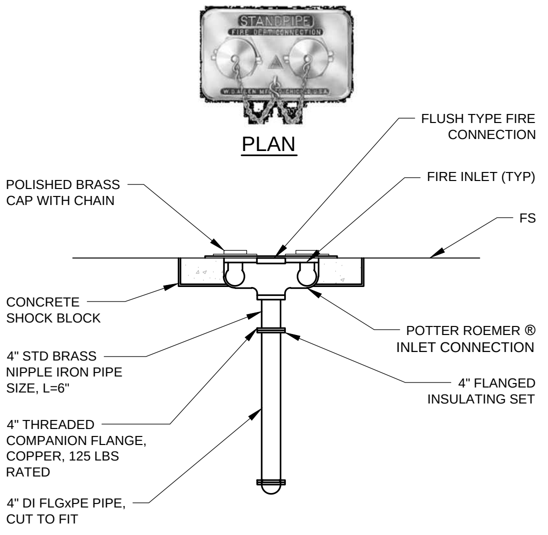


STORM AND SANITARY SEWERS IN COMMON TRENCH DETAIL
SCALE: 1:20



FIRE CONNECTION DETAIL
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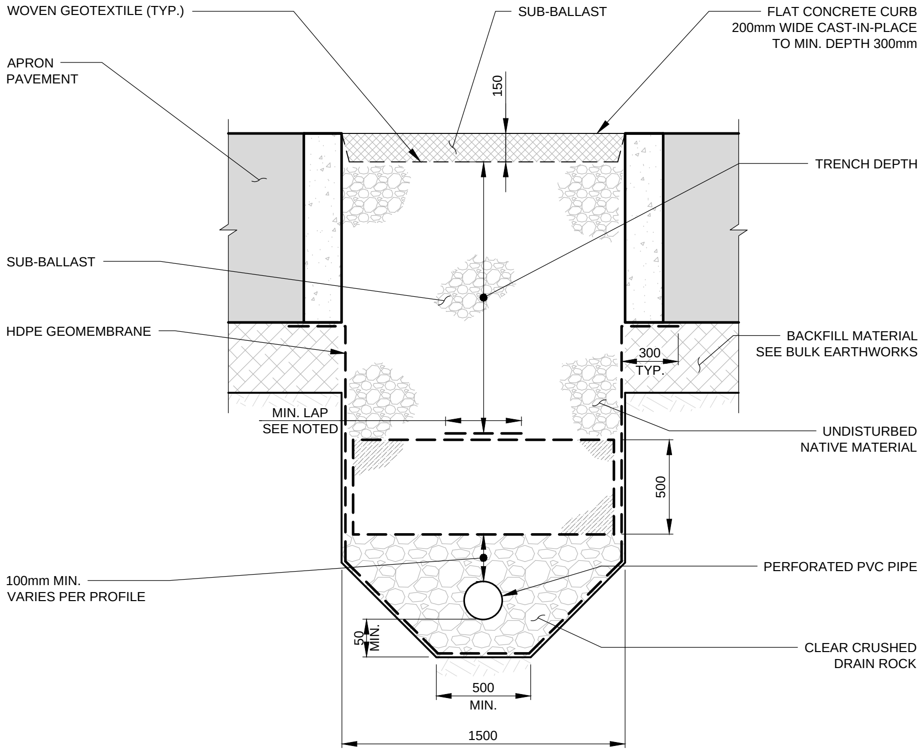

DRAIN TRENCH DETAIL
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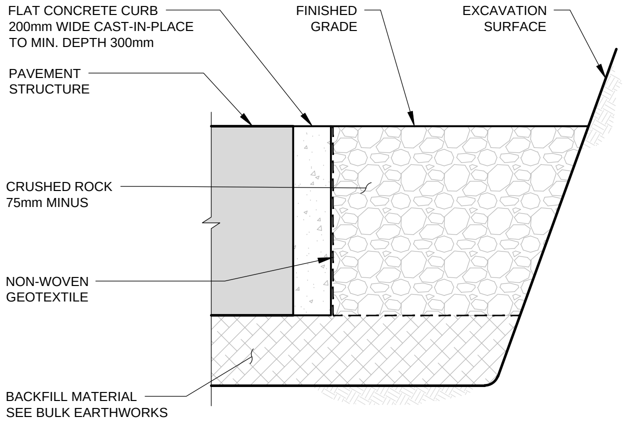
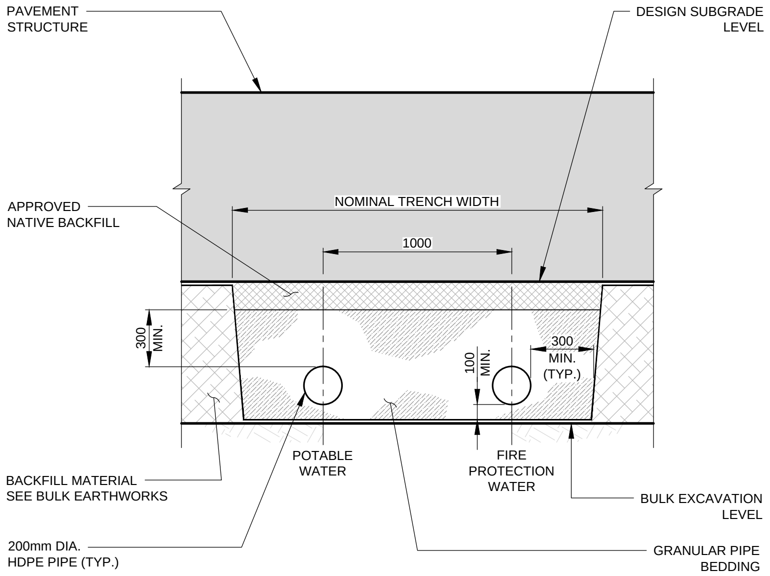


GRAVEL GUTTER DETAIL
SCALE: 1:20



WATER TRENCH DETAIL
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NOTES:
1) ALL DIMENSIONS IN MILLIMETERS (UNLESS OTHERWISE SHOWN).

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA NORTH AND SOUTH SITE
TYPICAL DETAILS - SHEET 1 OF 2

D
PROJECT/DWG No.: 329510-CV-100-S0-0500
REV No: A

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USER NAME: Horozian, Aram
PLOT DATE: Monday, March 31, 2014 3:13:18 PM

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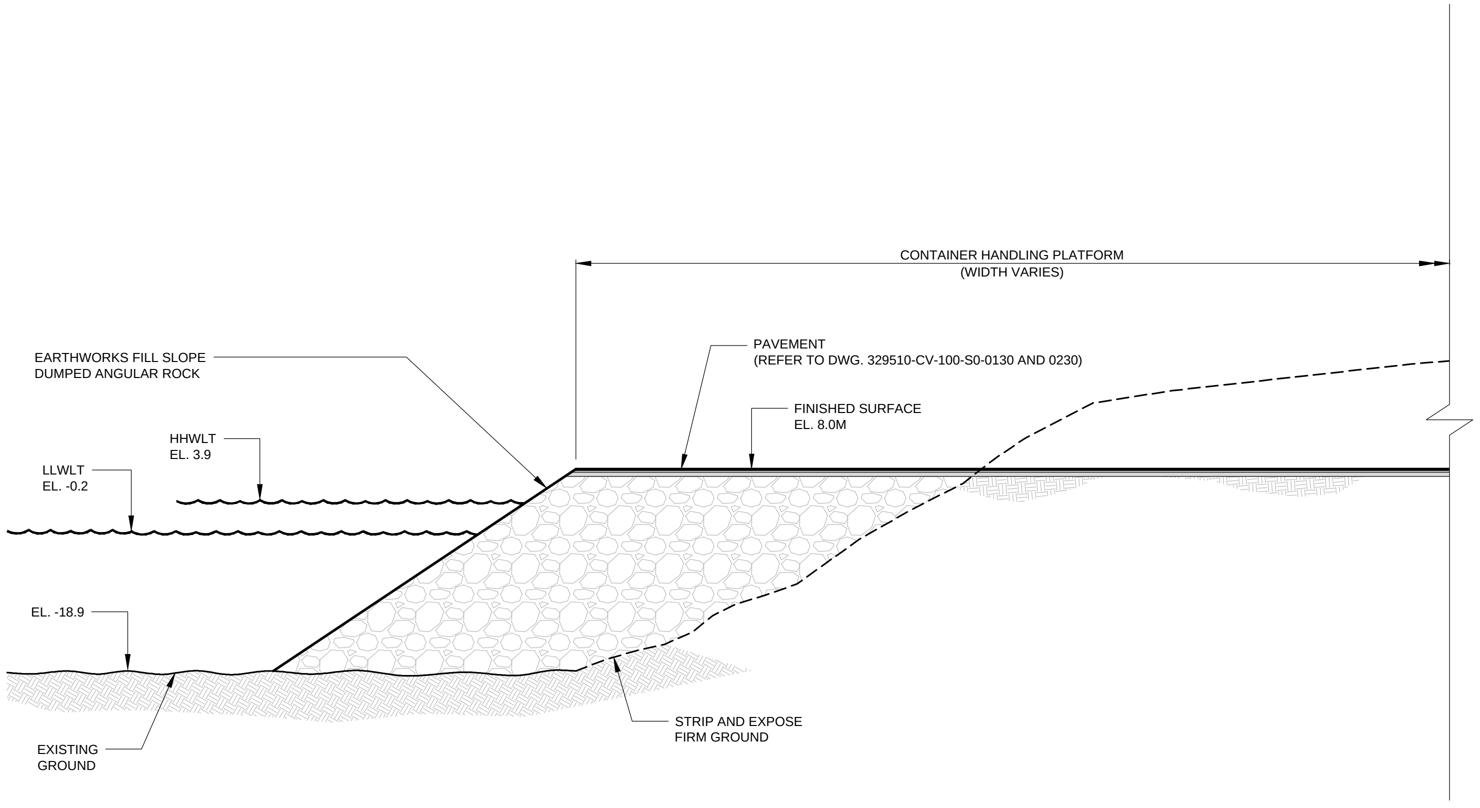
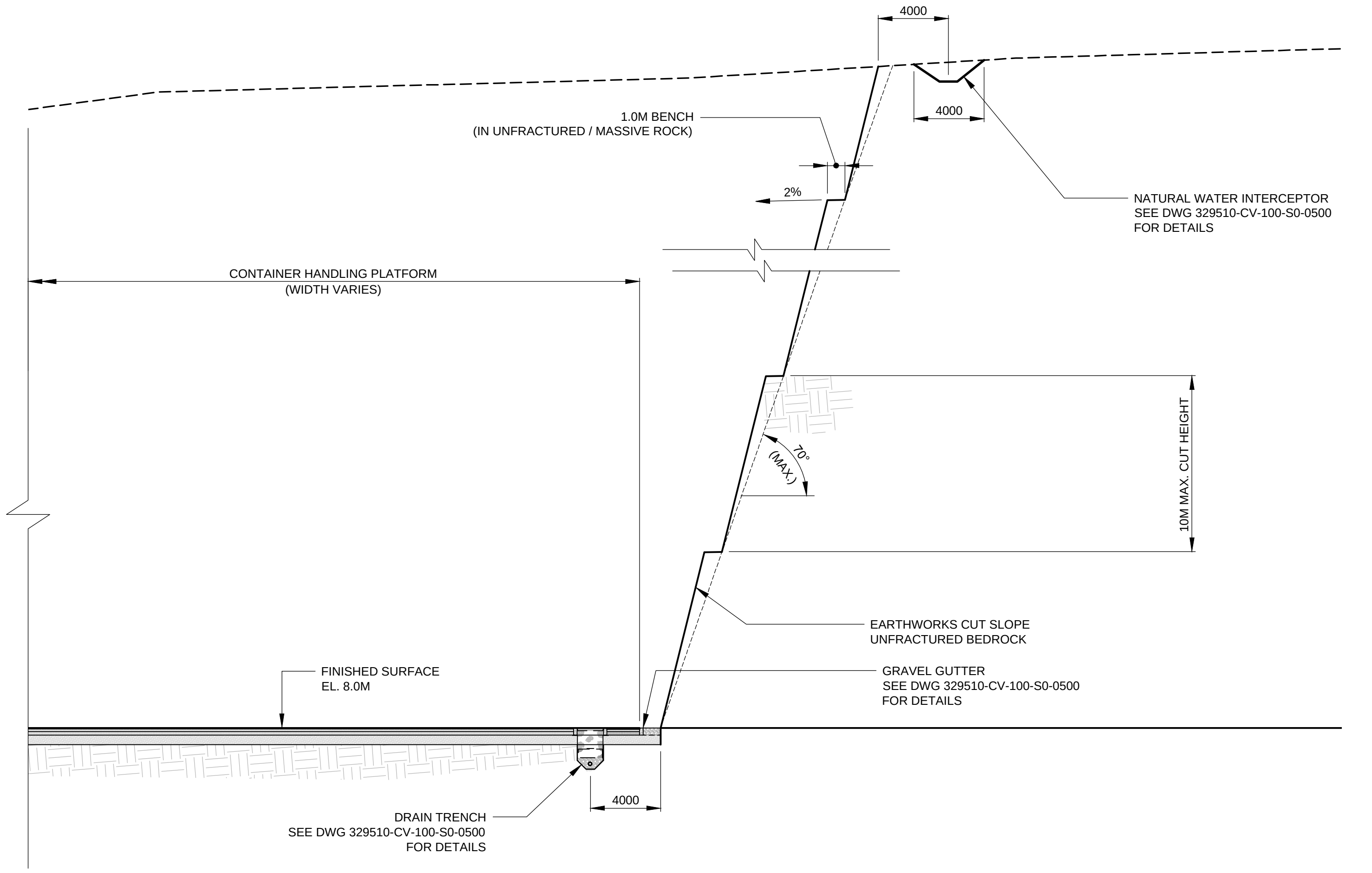
USER NAME: Horozian, Aram

PLOT DATE: Monday, March 31, 2014 5:44:00 PM



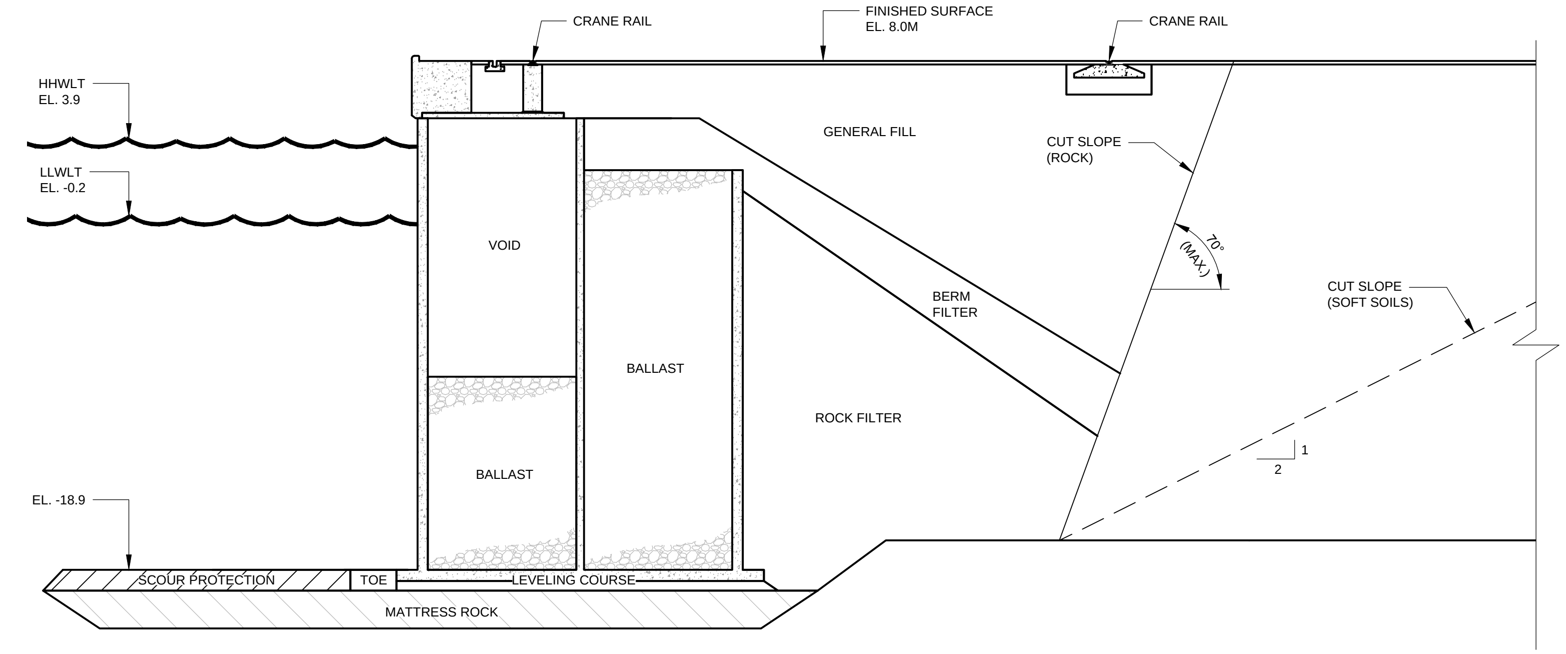
CONTAINER HANDLING PLATFORM - BULK EXCAVATION AT WEST PLATFORM FACE

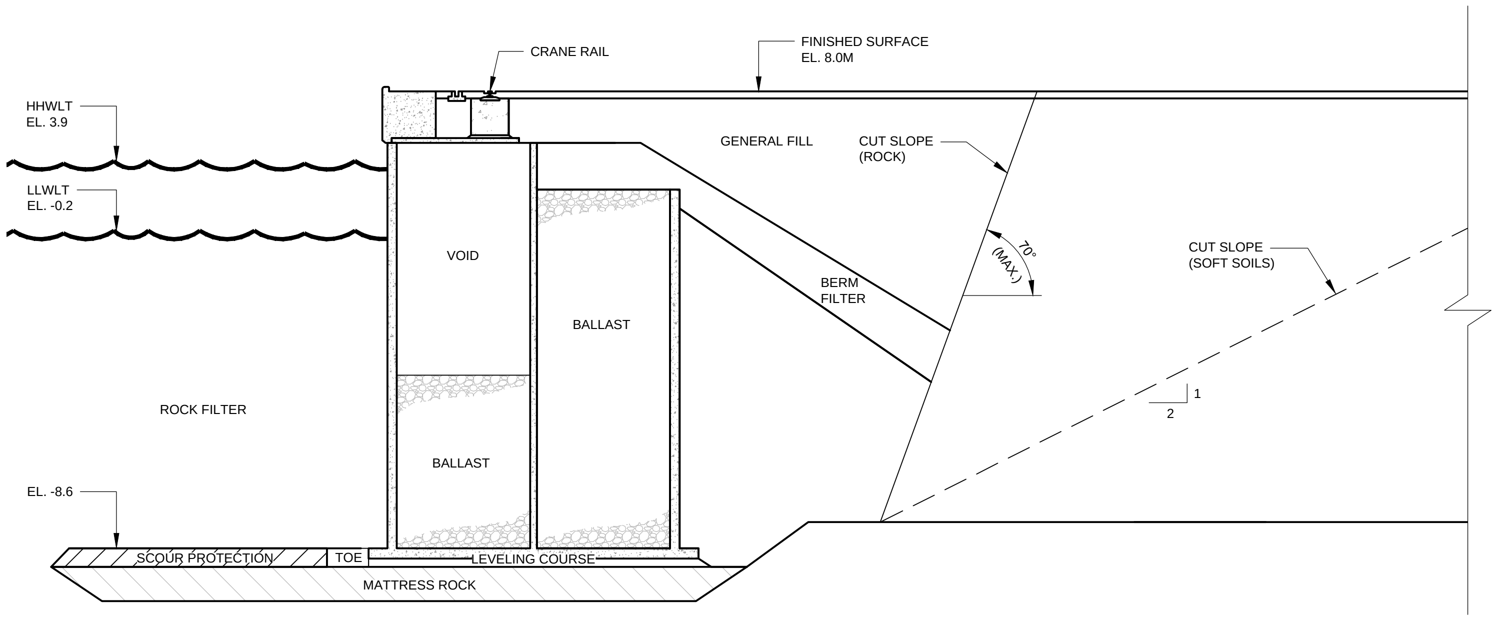
SCALE: 1:500



CONTAINER HANDLING PLATFORM - BULK EXCAVATION AT EAST PLATFORM FACE

SCALE: 1:200





NOTES:

1) ALL DIMENSIONS IN MILLIMETERS (UNLESS OTHERWISE SHOWN).

MAIN BERTH CAISSON DETAIL

SCALE: 1:200

FEEDER BERTH CAISSON DETAIL

SCALE: 1:100

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

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NO.	DESCRIPTION	BY	YYYY/MM/DD
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Hatch Mott MacDonald

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

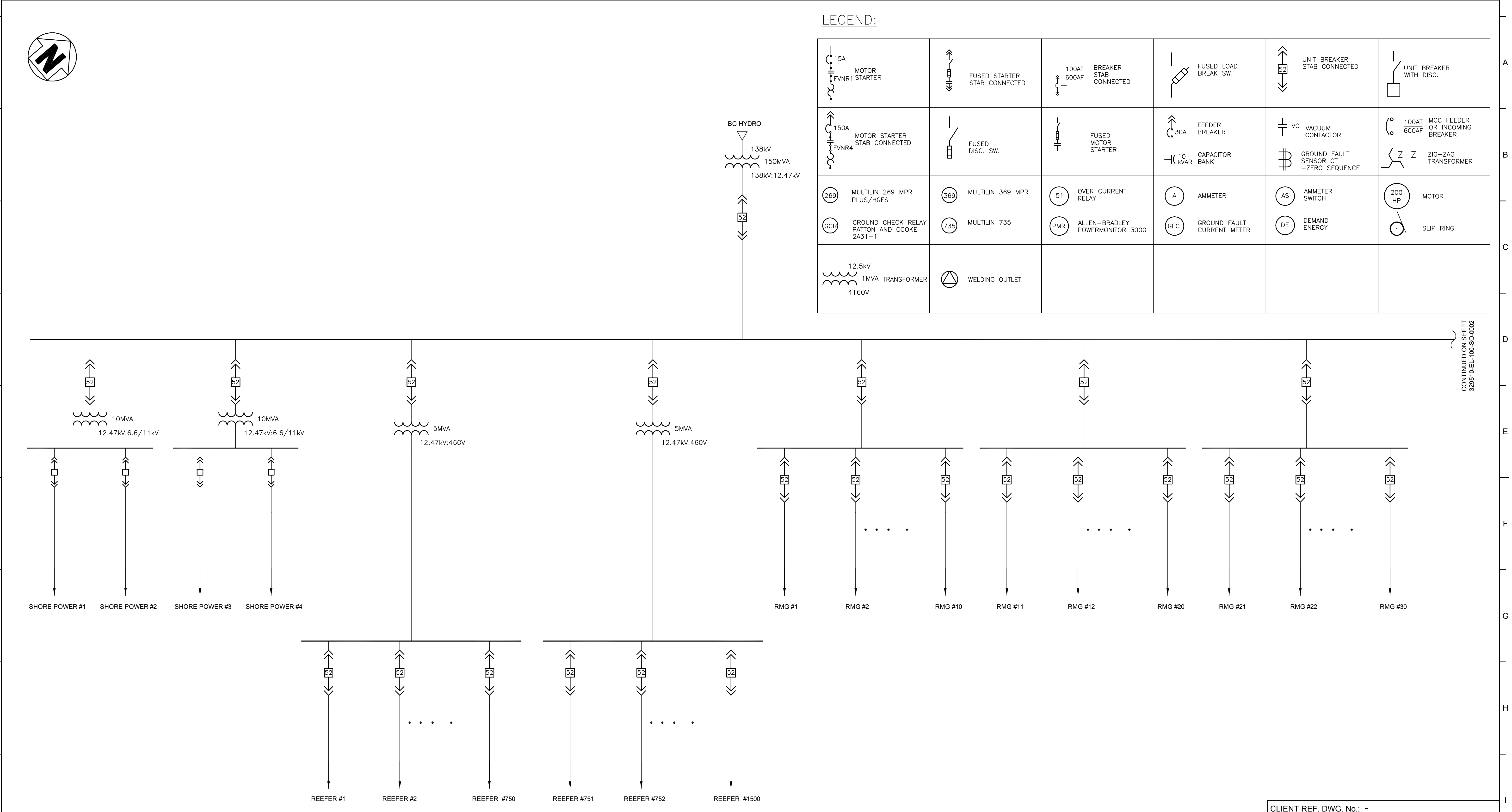
CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA NORTH AND SOUTH SITE
TYPICAL DETAILS - SHEET 2 OF 2

D

PROJECT/DWG No.: 329510-CV-100-S0-0501

REV No: A



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USER NAME: Soni, Abhinandan

PLOT DATE: Friday, March 28, 2014 8:38:13 AM

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Hatch Mott MacDonald

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CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH & SOUTH SITE

D

PROJECT/DWG No.: 329510-EL-100-SO-0001

REV No A

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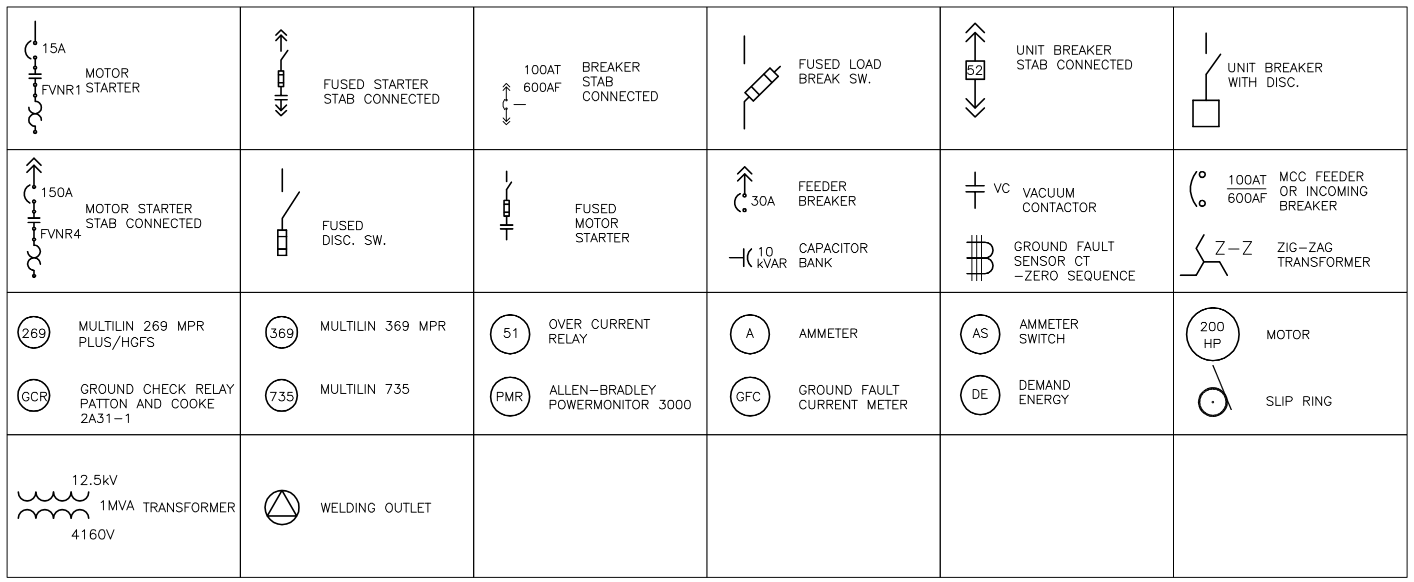

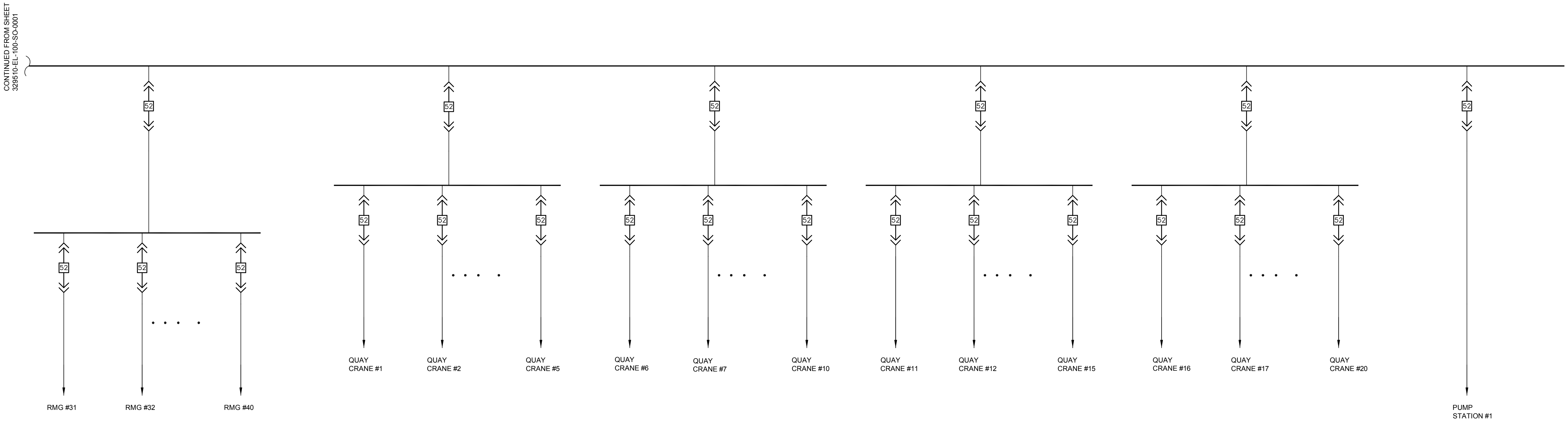

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CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
SARITA BAY NORTH & SOUTH SITE

D

PROJECT/DWG No.: 329510-EL-100-S0-0002

REV No A

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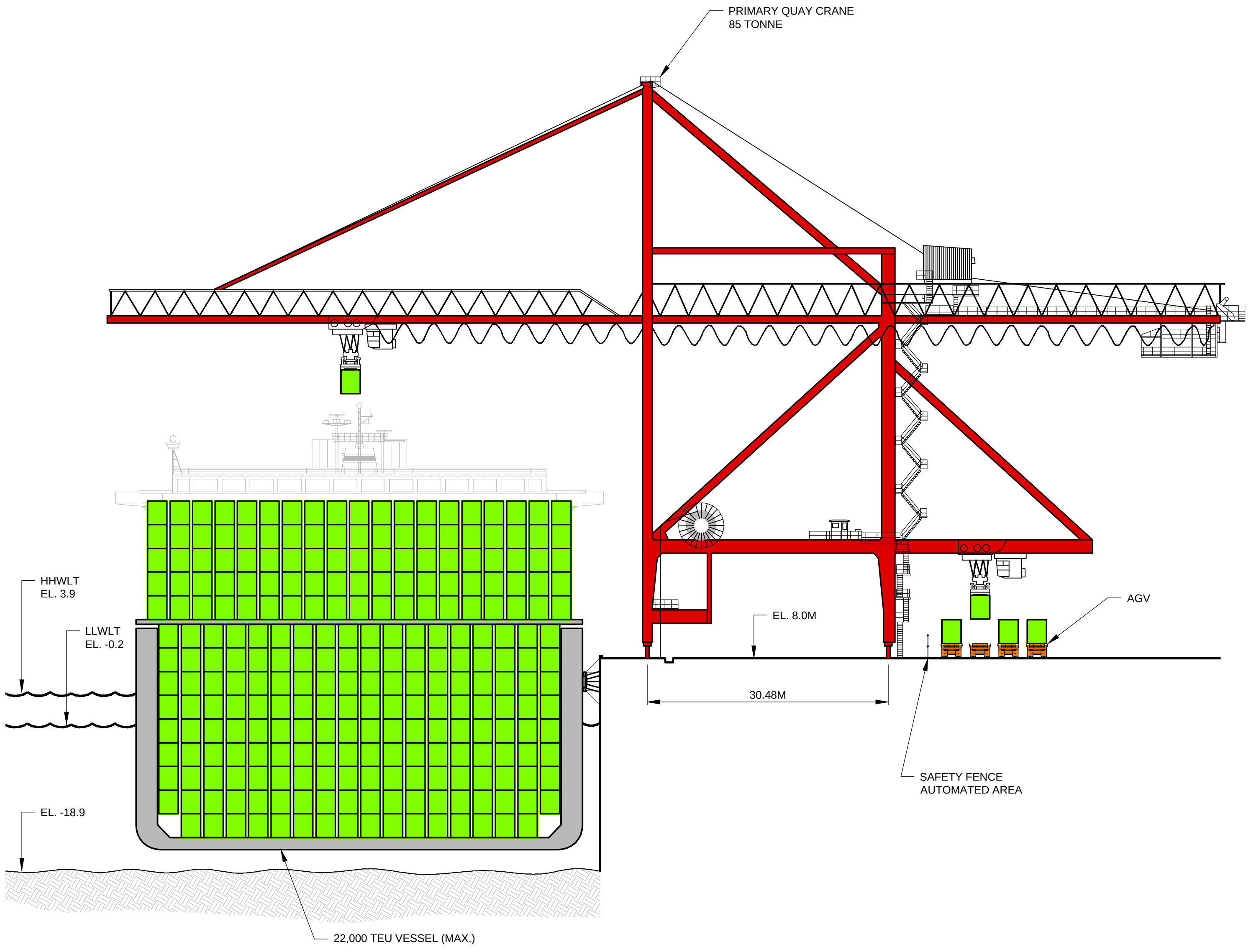

TYPICAL SECTION - MAIN BERTH
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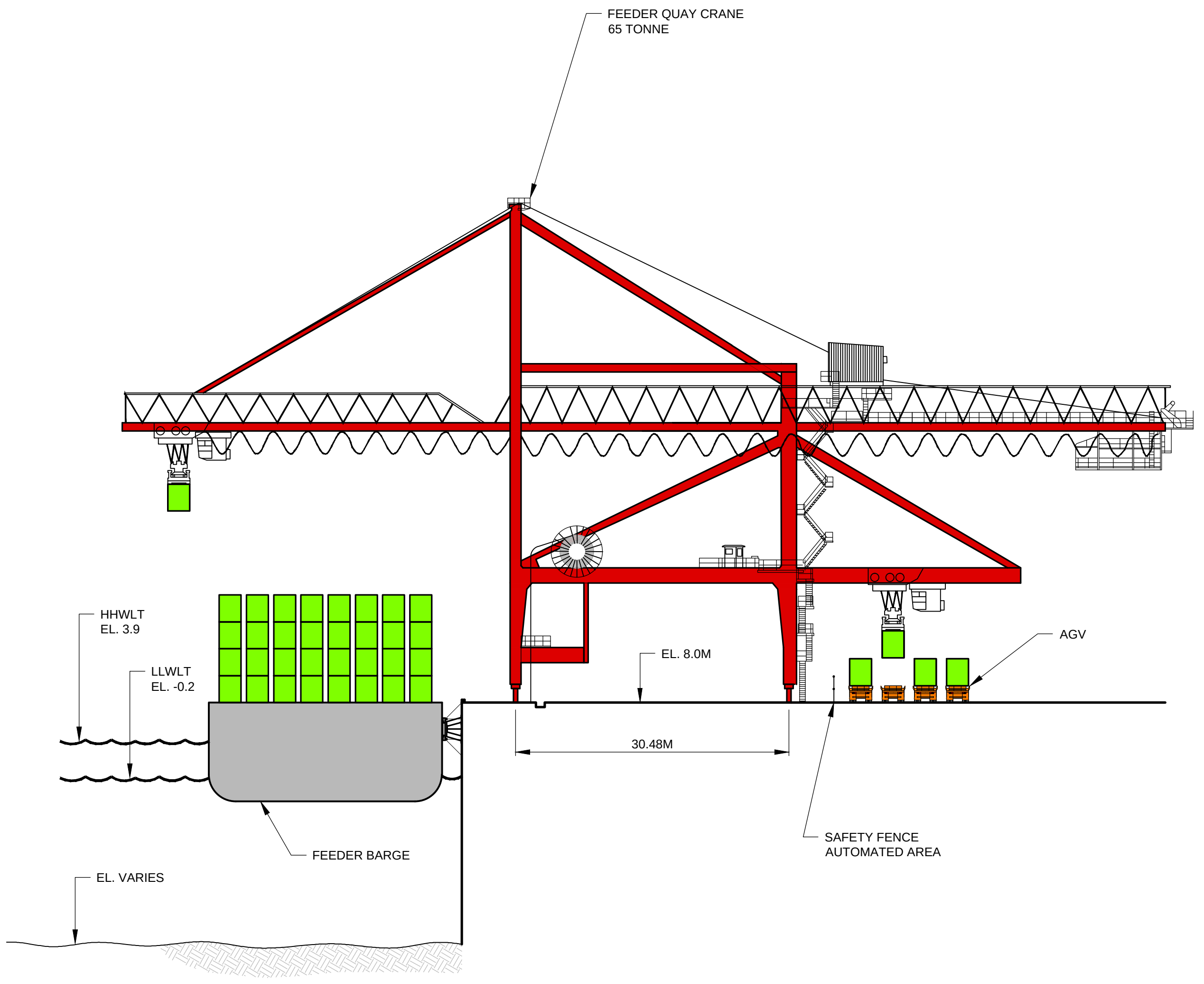

TYPICAL SECTION - FEEDER BERTH
SCALE: 1:400

REF.	DRAWING NUMBER	DRAWING TITLE

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
CONTAINER TRANSSHIPMENT TERMINAL
SHIP LOADING / OFF-LOADING DETAILS

D
PROJECT/DWG No.: 329510-MH-100-S0-0100
REV No: A

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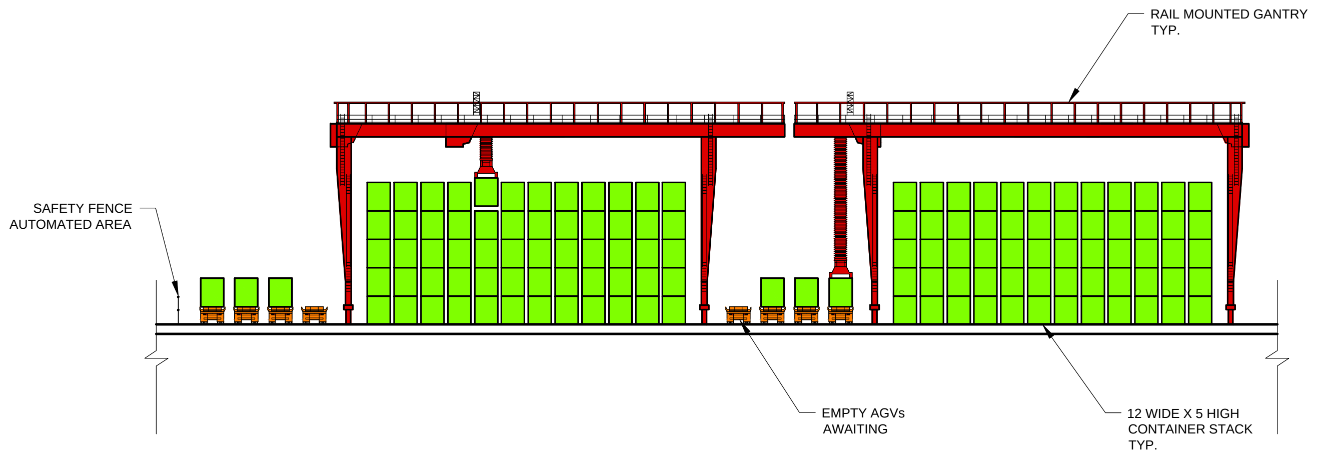
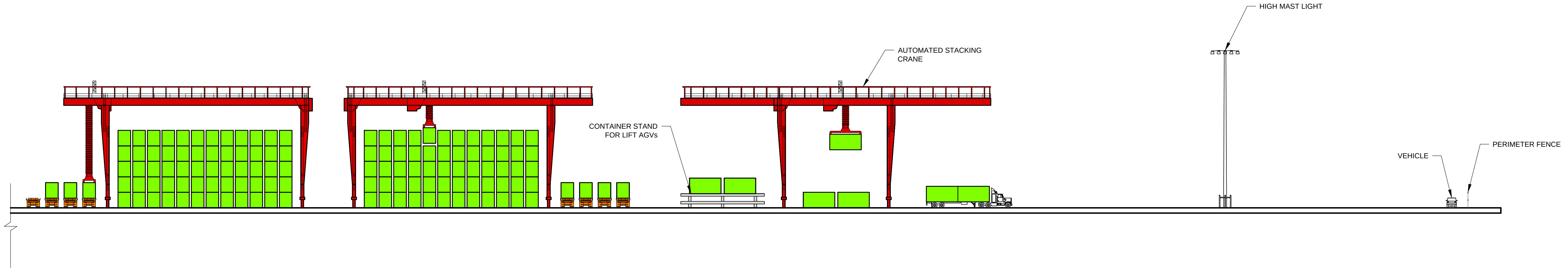


TYPICAL SECTION - CONTAINER YARD
SCALE: 1:400



TYPICAL SECTION - TRUCK LOADING AREA
SCALE: 1:400

REF.	DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

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Hatch Mott MacDonald

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SCALE: AS NOTED

CLIENT REF. DWG. No.: -

CLIENT: Port Alberni Port Authority

PORT ALBERNI TRANSSHIPMENT HUB
PRE-FEASIBILITY STUDY
CONTAINER TRANSSHIPMENT TERMINAL
CONTAINER HANDLING DETAILS

D

PROJECT/DWG No.: 329510-MH-100-S0-0101

REV No A

Appendix G CAPITAL COST ESTIMATE

PORT ALBERNI PORT AUTHORITY
Order of Magnitude Cost Estimate for PATH Project - SUMMARY SHEET

PROJECT: **PATH Pre-Feasibility Study**

Date: 26-Apr-14
Prepared by: A. Smitten
Project Number: 329510
Rev: D

Fully-Automated Terminal Phase - Pre Feasibility
(2,500,000TEU's/annum)

ITEM	DESCRIPTION	Sarita Bay North		Sarita Bay South - Option B		Sarita Bay South - Option A	
		AREA COST	CONTINGENCY $	AREA COST	CONTINGENCY $	AREA COST	CONTINGENCY $
1	MOBILIZATION/DEMOBILIZATION	$ 78,200,000	$ 11,730,000	$ 81,856,000	$ 12,278,000	$ 66,550,000	$ 9,983,000
2	DREDGING AND LAND RECLAMATION	$ 211,452,000	$ 52,863,000	$ 156,780,000	$ 39,195,000	$ 46,792,800	$ 11,698,200
3	REMOVALS AND SITE PREPARATION	$ 2,947,500	$ 442,100	$ 2,110,000	$ 316,500	$ 2,888,750	$ 433,300
4	EXCAVATION AND FILL - Terminal Site	$ 333,674,118	$ 50,051,118	$ 487,103,824	$ 73,065,574	$ 304,215,000	$ 45,632,250
5	WHARF STRUCTURAL	$ 194,189,000	$ 28,691,100	$ 185,249,800	$ 27,363,200	$ 171,257,540	$ 25,224,800
6	CIVIL & MISC. STRUCTURAL TERMINAL INFRASTRUCTURE	$ 106,904,000	$ 14,357,400	$ 106,229,900	$ 14,336,600	$ 106,184,900	$ 14,332,100
7	OFFSITE IMPROVEMENTS	$ 19,068,000	$ 4,360,200	$ 4,116,500	$ 617,500	$ 4,116,500	$ 617,500
8	GATE COMPLEX	$ 3,372,500	$ 505,900	$ 3,407,500	$ 511,100	$ 3,407,500	$ 511,100
9	BUILDINGS	$ 26,860,000	$ 2,686,000	$ 26,573,000	$ 2,657,300	$ 26,573,000	$ 2,657,300
10	ELECTRICAL TERMINAL INFRASTRUCTURE	$ 51,665,000	$ 12,916,300	$ 51,684,000	$ 12,921,000	$ 51,684,000	$ 12,921,000
11	CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL	$ 613,873,000	$ 61,387,300	$ 613,873,000	$ 61,387,300	$ 613,873,000	$ 61,387,300
TOTAL FOR CAPITAL COST CONSTRUCTION		**$1,642,205,118**	**$239,990,418**	**$1,718,983,524**	**$244,649,074**	**$1,397,542,990**	**$185,397,850**
TOTAL FOR CAPITAL CONSTRUCTION, INCL. CONTINGENCY		**$1,882,195,535**		**$1,963,632,597**		**$1,582,940,840**	
12	PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION	$ 188,850,000	$ 37,771,000	$ 197,680,000	$ 39,536,600	$ 160,720,000	$ 32,143,500
TOTAL FOR PROJECT		**$1,831,100,000**	**$277,800,000**	**$1,916,700,000**	**$284,200,000**	**$1,558,300,000**	**$217,500,000**
TOTAL FOR CONSTRUCTION, INCL. CONTINGENCY		**$2,108,900,000**		**$2,200,900,000**		**$1,775,800,000**	

Revision Notes:

Rev D - 26-Apr-14: Line items 6.3e and 11.4 - 11.7 (in detailed breakdown) revised unit price to reflect updated supplier pricing received from Terex Port Solutions

PORT ALBERNI PORT AUTHORITY
Order of Magnitude Cost Estimate for PATH Project - Sarita Bay North OPTION B

PROJECT: PATH Pre-Feasibility Study

Date: 26-Apr-14
Prepared by: A. Smitten
Project Number: 329510
Rev: D

Fully-Automated Terminal Phase - Pre Feasibility
(2,500,000TEU's/annum)

ITEM	DESCRIPTION		UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
								%	$
1	**MOBILIZATION/DEMOBILIZATION**								
1.1	Mobilization/Demobilization		L.S.	1	5%	$ 78,200,000		15%	$11,730,000
SUB-TOTAL FOR MOBILIZATION / DEMOBILIZATION							**$78,200,000**		**$11,730,000**
2	**DREDGING AND LAND RECLAMATION**								
	Total Dredge Volume (Primary and Feeder Basins)		cu.m.	1,315,000					
2.1	Dredging & Disposal								
	a	Excavator/Hydraulic Cutter Dredge and Upland Disposal	cu.m.	1,315,000	$ 160.00	$ 210,400,000		25%	$52,600,000
	b	Upland Disposal Environmental Mitigation (Berms, Ditching, Hydroseed, etc.)	LS	210,400,000	0.50%	$ 1,052,000		25%	$263,000
2.2	Dredging & Disposal								
	a	Import Fill (Sand) for Land Reclamation to El. +8.0m +/- (Subgrade Elevation)	cu.m.	0	$ 39.00	$ -		25%	$0
	b	Slope & Scour Protection	cu.m.	0	$ 180.00	$ -		25%	$0
SUB-TOTAL FOR DREDGING AND LAND RECLAMATION							**$211,452,000**		**$52,863,000**
3	**REMOVALS AND SITE PREPARATION**								
3.1	Tree Clearance / Logging								
	a	Terminal Site	sq.m	727,000	$ 2.50	$ 1,817,500		15%	$272,625
	b	Access Roads / Utility Corridors	sq.m	31,000	$ 2.50	$ 77,500		15%	$11,625
3.2	Clear and Grub (Vegetation)								
	a	Terminal Site	sq.m	808,000	$ 1.25	$ 1,010,000		15%	$151,500
	b	Access Roads / Utility Corridors	sq.m	34,000	$ 1.25	$ 42,500		15%	$6,375
SUB-TOTAL FOR REMOVALS AND SITE PREPARATION							**$2,947,500**		**$442,100**
4	**EXCAVATION AND FILL - Terminal Site**								
4.1	General Excavation (Excavate) - Assume 300mm top soil/organics etc		cu.m.	860,000	$ 14.00	$ 12,040,000		15%	$1,806,000
4.2	Rock Excavation (Drill, blast, excavate)		cu.m.	7,740,000	$ 29.00	$ 224,460,000		15%	$33,669,000
4.3	General Fill (600mm minus)		cu.m.	2,180,000	$ 28.00	$ 61,040,000		15%	$9,156,000
4.4	Haul and Dispose general excavated material		cu.m.	860,000	$ 10.00	$ 8,600,000		15%	$1,290,000
4.5	Haul and Dispose blasted rock material		cu.m.	2,753,412	$ 10.00	$ 27,534,118		15%	$4,130,118
SUB-TOTAL FOR DREDGING AND LAND RECLAMATION							**$333,674,118**		**$50,051,118**
5	**WHARF STRUCTURAL**								
5.1	Concrete Caisson Wharf								
	Total Length of Wall		**lin. M**	**1,510**					
	Number of Container Berths		**ea.**	**2**					
	a	Caisson Concrete	cu.m.	181,000	$ 340.00	$ 61,540,000		15%	$9,231,000
	b	Caisson Re-bar	kg	28,600,000	$ 2.00	$ 57,200,000		15%	$8,580,000
	c	Matress Rock	tonnes	195,500	$ 25.00	$ 4,887,500		15%	$733,125
	d	Caisson Towing and Set-down	ea.	52	$ 128,000.00	$ 6,656,000		15%	$998,400
	e	Ballast Rock	tonnes	562,000	$ 10.00	$ 5,620,000		15%	$843,000
	f	Cope Beam Concrete	cu.m.	13,500	$ 398.00	$ 5,373,000		15%	$805,950
	g	Cope Beam Re-bar	kg	2,010,000	$ 2.00	$ 4,020,000		15%	$603,000
	h	Caisson Backfill (600mm minus)	tonnes	2,580,000	$ 12.00	$ 30,960,000		15%	$4,644,000
	i	Scour Protection	tonnes	55,000	$ 112.50	$ 6,187,500		15%	$928,125
5.2	Crane Rail System (Crane Rail, Crane Beams)								
	Length of Crane Beam		**lin. m**	**1,450**					
	a	CIP Concrete Front Crane Beam	cu.m.	4,000	$ 398.00	$ 1,592,000		10%	$159,200
	b	CIP Concrete Rear Crane Beam	cu.m.	3,500	$ 398.00	$ 1,393,000		10%	$139,300
	c	Crane Beam Rebar (front and rear)	kg	1,160,000	$ 2.00	$ 2,320,000		10%	$232,000
	d	Rear Crane Beam Granular Base	tonnes	13,500	$ 32.00	$ 432,000		10%	$43,200
	e	Crane Rail & Fixation	lin.m.	2,900	$ 820.00	$ 2,378,000		10%	$237,800
	f	Crane Rail Stops	ea.	10	$ 2,800.00	$ 28,000		10%	$2,800
	g	Stowage Pins	ea.	40	$ 3,800.00	$ 152,000		10%	$15,200
5.3	Miscellaneous Wharf Elements								
	a	Mooring System (Bollards) - Main Berths	ea.	100	$ 5,000.00	$ 500,000		10%	$50,000
	b	Mooring System (Bollards) - Feeder Berths	ea.	30	$ 5,000.00	$ 150,000		10%	$15,000
	c	Crane Power Vault	ea.	20	$ 10,000.00	$ 200,000		25%	$50,000
	d	Ship Service Pit	ea.	4	$ 200,000.00	$ 800,000		25%	$200,000
	e	Fenders - Main Berths	ea.	70	$ 20,000.00	$ 1,400,000		10%	$140,000
	f	Fenders - Feeder Berths	ea.	20	$ 20,000.00	$ 400,000		10%	$40,000
SUB-TOTAL FOR WHARF STRUCTURE							**$194,189,000**		**$28,691,100**
6	**CIVIL & MISC. STRUCTURAL TERMINAL INFRASTRUCTURE**								
6.1	Civil Utilities								
	a	Fire Protection Water Distribution System (Pipes, Valves)	lin.m.	6,300	$ 260.00	$ 1,638,000		15%	$245,700
	b	Fire Hydrants - aboveground	ea.	30	$ 5,800.00	$ 174,000		15%	$26,100
	c	Fire Hydrants - underground (concrete box)	ea.	20	$ 7,600.00	$ 152,000		15%	$22,800
	d	Intake Pump Station for Fire Protection (Pumps, & Motors, Valves)	Allowance	1	$ 12,000.00	$ 12,000		15%	$1,800
	e	Domestic Water Treatment System	Allowance	1	$ 100,000.00	$ 100,000		15%	$15,000
	f	Domestic Water Distribution System (Mains, Services, Valves, Bends, Tees, Crosses, Pumps?)	lin.m.	4,100	$ 280.00	$ 1,148,000		15%	$172,200
	g	Sanitary Sewer Collection Pipes (mains, services)	lin.m.	3,200	$ 440.00	$ 1,408,000		15%	$211,200
	h	Sanitary Sewer Manholes	ea.	15	$ 6,500.00	$ 97,500		15%	$14,625
	i	Sanitary Sewer Pumps (manhole)	ea.	10	$ 4,800.00	$ 48,000		15%	$7,200
	j	Sanitary Treatment Unit and River Disposal (Anaerobic/Aerobic/UV Treatment)	Allowance	1	$ 65,000.00	$ 65,000		15%	$9,750
	k	Natural Runoff Water Interceptor Channel	lin.m.	1,600	$ 85.00	$ 136,000		15%	$20,400
	l	Storm Water Collection Pipes (mains)	lin.m.	1,700	$ 440.00	$ 748,000		15%	$112,200
	m	Storm Water Manholes	ea.	20	$ 6,500.00	$ 130,000		15%	$19,500
	n	Storm Water Pumps	ea.	6	$ 4,800.00	$ 28,800		15%	$4,320
	o	Storm Water Drain Trenches (French Drains)	lin.m.	11,400	$ 180.00	$ 2,052,000		15%	$307,800
	p	Storm Water Treatment and River Disposal	ea.	10	$ 65,000.00	$ 650,000		15%	$97,500
	q	Storm Water Oil Separator	ea.	5	$ 45,000.00	$ 225,000		15%	$33,750
	r	Storm Water Treatment Wetland	ea.	1	$ 100,000.00	$ 100,000		15%	$15,000
	s	Utility Service Pits (for docked ships)	ea.	4	$ 25,000.00	$ 100,000		15%	$15,000
6.2	Civil Pavement Structures (Asphalt/Concrete, Base and Subbase Gravel)								
	a	Heavy Duty Pavement for Berth, Container Yard, Access Roads and Gate Area	sq.m.	540,000	$ 52.00	$ 28,080,000		10%	$2,808,000
	b	Light/Medium Duty Pavement for POV/Equipment Parking Area	sq.m.	240,000	$ 35.00	$ 8,400,000		10%	$840,000
	c	Gravel paving for non-trafficked areas	sq.m.	31,000	$ 15.00	$ 465,000		10%	$46,500
	d	RMG Concrete Runways (Container Yard)	lin.m.	15,000	$ 1,216.00	$ 18,240,000		10%	$1,824,000
	e	RMG Concrete Granular Base	cu. m.	48,000	$ 51.00	$ 2,448,000		10%	$244,800
	f	RMG Rails (Container Yard)	lin.m.	14,600	$ 820.00	$ 11,972,000		10%	$1,197,200
	g	RMG Rail Stops (Container Yard)	ea.	72	$ 2,800.00	$ 201,600		10%	$20,160
	h	RMG Stowage Pins	ea.	80	$ 3,800.00	$ 304,000		10%	$30,400
	i	Truck Loading Area Concrete Runways	lin.m.	530	$ 1,216.00	$ 644,480		10%	$64,448
	j	Truck Loading Area Concrete Granular Base	cu. m.	1,700	$ 51.00	$ 86,700		10%	$8,670
	k	Truck Loading Area Rails	lin.m.	500	$ 820.00	$ 410,000		10%	$41,000
	l	Truck Loading Area Rail Stops	ea.	4	$ 2,800.00	$ 11,200		10%	$1,120
	m	Truck Loading RMG Stowage Pins	ea.	20	$ 3,800.00	$ 76,000		10%	$7,600
	n	RMG & ASC Power Vaults	ea.	50	$ 10,000	$ 500,000		10%	$50,000
	o	Misc. Concrete Slabs (Fueling Station, Washdown Area)	sq.m.	10,800	$ 225.00	$ 2,430,000		10%	$243,000
	p	Misc. Concrete Strips for Container Castings	cu.m.	0	$ 900.00	$ -		10%	$0
6.3	Miscellaneous Civil and Structural								
	a	Fencing and Gates	lin.m.	4,000	$ 160.00	$ 640,000		10%	$64,000
	b	Automated Area Safety Fence	lin.m.	4,000	$ 160.00	$ 640,000		10%	$64,000
	c	Pavement Markings	Allowance	1	$ 80,000.00	$ 80,000		25%	$20,000
	d	Reefer Tower Structures	ea.	25	$ 382,500.00	$ 9,562,500		25%	$2,390,625
	e	Fueling / Charging Facility	L.S.	2	$ 5,900,000.00	$ 11,800,000		25%	$2,950,000
	f	Customs Portal Radiation Monitors (RPM)	ea.	2	$ 450,000.00	$ 900,000		10%	$90,000
SUB-TOTAL FOR CIVIL TERMINAL INFRASTRUCTURE							**$106,904,000**		**$14,357,400**

ITEM	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
							%	$
7	**OFFSITE IMPROVEMENTS**							
7.1	Existing Drainage Channel Relocations	Allowance			$ -			$0
7.2	Access Roads / Utility Corridors							
	a General Excavation (Excavate) - Assume 300mm top soil/organics etc	cu.m.	4,000	$ 14.00	$ 56,000		15%	$8,400
	b Rock Excavation (Drill, blast, excavate)	cu.m.	36,000	$ 29.00	$ 1,044,000		15%	$156,600
	c Haul and Dispose general excavated material	cu.m.	4,000	$ 10.00	$ 40,000		15%	$6,000
	d Haul and Dispose blasted rock material	cu.m.	11,000	$ 10.00	$ 110,000		15%	$16,500
	e Sub-grade - General Fill (75mm minus)	cu.m.	12,000	$ 28.00	$ 336,000		15%	$50,400
	f Sub-base - 75mm well graded granular material	cu.m.	10,000	$ 28.00	$ 280,000		15%	$42,000
	g Base - 25mm minus granular material	cu.m.	3,500	$ 57.00	$ 199,500		15%	$29,925
	h Asphalt	cu.m.	0	$ 45.00	$ -		15%	$0
7.3	Bridge Crossing	Allowance	1	$ 15,000,000.00	$ 15,000,000		25%	$3,750,000
7.4	Culverts (assume 300mm CSP)	ea.	14	$ 3,200.00	$ 46,208		15%	$6,931
7.5	Domestic Water Distribution System (Pipes, Valves)	lin.m.	5,200	$ 280.00	$ 1,456,000		15%	$218,400
7.6	Fire Water Reserve Tank	Allowance	1	$ 500,000.00	$ 500,000		15%	$75,000
7.7	Sanitary Sewer Collection System (Pipes, MHs)	lin.m.	0	$ 465.00	$ -		15%	$0
	SUB-TOTAL FOR OFFSITE IMPROVEMENTS					**$19,068,000**		**$4,360,200**
8	**GATE COMPLEX**							
8.1	Pre-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)	lane	2	$ 200,000.00	$ 400,000		15%	$60,000
8.2	In-Gate (Gate Arms, Cameras, Communication, Bollards, Electrical)	lane	7	$ 200,000.00	$ 1,400,000		15%	$210,000
8.3	Out-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)	lane	4	$ 200,000.00	$ 800,000		15%	$120,000
8.4	Roadside Barriers	lin.m.	300	$ 175.00	$ 52,500		15%	$7,875
8.5	Canopies (Pre, In and Out Gates)	sq.m.	2,400	$ 300.00	$ 720,000		15%	$108,000
	SUB-TOTAL FOR GATE COMPLEX					**$3,372,500**		**$505,900**
9	**BUILDINGS**							
9.1	Administration Building (2 Floors)	sq.m.	3,600	$ 3,200.00	$ 11,520,000		10%	$1,152,000
9.2	Maintenance Building	sq.m.	3,900	$ 2,900.00	$ 11,310,000		10%	$1,131,000
9.3	LEED Certification (5%)	%	$ 22,830,000	5%	$ 1,141,500		10%	$114,150
9.4	Gate House	sq.m.	25	$ 2,600.00	$ 65,000		10%	$6,500
9.5	Substation Buildings	L.S.	1	$ 532,224.00	$ 532,224		10%	$53,222
9.6	Compressor Building	L.S.	1	$ 268,800.00	$ 268,800		10%	$26,880
9.7	Wastewater Treatment Building	L.S.	1	$ 224,000.00	$ 224,000		10%	$22,400
9.8	Potable Water Treatment Building	L.S.	1	$ 224,000.00	$ 224,000		10%	$22,400
9.9	Fire Pumphouse	L.S.	1	$ 134,400.00	$ 134,400		10%	$13,440
9.10	Fuel Facility	L.S.	1	$ 384,000.00	$ 384,000		10%	$38,400
9.11	Marine Ammenities Building	L.S.	3	$ 352,000.00	$ 1,056,000		10%	$105,600
	SUB-TOTAL FOR BUILDINGS					**$26,860,000**		**$2,686,000**
10	**ELECTRICAL TERMINAL INFRASTRUCTURE**							
10.1	Power Supply to Site	L.S.	1	$ 10,500,000.00	$ 10,500,000		25%	$2,625,000
10.2	Main Substation	ea.	1	$ 2,500,000.00	$ 2,500,000		25%	$625,000
10.3	Reefer Substations	ea.	2	$ 1,800,000.00	$ 3,600,000		25%	$900,000
10.4	RMG Substations	ea.	4	$ 1,800,000.00	$ 7,200,000		25%	$1,800,000
10.5	Quay Crane Substation	ea.	4	$ 1,800,000.00	$ 7,200,000		25%	$1,800,000
10.6	Shore Power Substation	ea.	2	$ 1,800,000.00	$ 3,600,000		25%	$900,000
10.7	Water In-Take Substation	ea.	1	$ 1,800,000.00	$ 1,800,000		25%	$450,000
10.8	Gate Electrical	L.S.	1	$ 75,000.00	$ 75,000		25%	$18,750
10.9	High Mast Lighting Complete (Foundation, Pole, Fixture, Conduit)	ea.	20	$ 9,500.00	$ 190,000		25%	$47,500
10.10	Power and Communication Distribution	L.S.	1	$ 15,000,000.00	$ 15,000,000		25%	$3,750,000
	a Cable Ductwork	m	10,000	$ 180.00	$ 1,800,000		15%	$270,000
	b 15 kV cable	m	100,000	$ 360.00	$ 36,000,000		15%	$5,400,000
	c Optical Fibre	m	50,000	$ 2.50	$ 125,000		15%	$18,750
	SUB-TOTAL FOR ELECTRICAL TERMINAL INFRASTRUCTURE					**$51,665,000**		**$12,916,300**
11	**CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL**							
11.1	Primary Ship-to-Shore Cranes	ea.	14	$ 12,000,000.00	$ 168,000,000		10%	$16,800,000
11.2	Feeder Ship-to-Shore Cranes	ea.	6	$ 9,000,000.00	$ 54,000,000		10%	$5,400,000
11.3	Spare STS Crane Spreaders	ea.	5	$ 200,000.00	$ 1,000,000		10%	$100,000
11.4	Container Yard Rail Mounted Gantries	ea.	40	$ 4,815,000.00	$ 192,600,000		10%	$19,260,000
11.5	Truck loading RMGs	ea.	8	$ 3,000,000.00	$ 24,000,000		10%	$2,400,000
11.6	Automated Guided Vehicles	ea.	136	$ 1,185,000.00	$ 161,160,000		10%	$16,116,000
11.7	Lift Automated Guided Vehicles	ea.	8	$ 1,303,500.00	$ 10,428,000		10%	$1,042,800
11.8	Top-pick Container Handlers	ea.	1	$ 600,000.00	$ 600,000		10%	$60,000
11.9	Telehandlers	ea.	1	$ 315,000.00	$ 315,000		10%	$31,500
11.10	Hustler & Bombcart	ea.	2	$ 175,000.00	$ 350,000		10%	$35,000
11.11	Fuel/Repair Trucks	ea.	4	$ 130,000.00	$ 520,000		10%	$52,000
11.12	Pick-up Trucks	ea.	20	$ 45,000.00	$ 900,000		10%	$90,000
	SUB-TOTAL FOR CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL					**$613,873,000**		**$61,387,300**
	TOTAL FOR CAPITAL COST CONSTRUCTION					**$1,642,205,118**	**15%**	**$239,990,418**
	TOTAL FOR CAPITAL CONSTRUCTION, INCL. CONTINGENCY						**$1,882,195,535**	
12	**PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION**							
12.1	Permitting - Allowance 10% of Construction Costs	L.S.	$1,642,205,118	10%	$ 164,220,512		20%	$32,844,102
12.2	Procurement & Contract Administration at 1.5% of Purchase Price	ea.	1,642,205,118	1.5%	$ 24,633,077		20%	$4,926,615
	SUB-TOTAL FOR PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION					**$188,850,000**		**$37,771,000**
	TOTAL FOR PROJECT					**$1,831,100,000**	**15%**	**$277,800,000**
	TOTAL FOR CONSTRUCTION, INCL. CONTINGENCY						**$2,108,900,000**	

PORT ALBERNI PORT AUTHORITY
Order of Magnitude Cost Estimate for PATH Project - Sarita Bay South OPTION B

PROJECT: PATH Pre-Feasibility Study

Date: 26-Apr-14
Prepared by: A. Smitten
Project Number: 329510
Rev: D

Fully-Automated Terminal Phase - Pre Feasibility
(2,500,000TEU's/annum)

ITEM	DESCRIPTION		UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
								%	$
1	**MOBILIZATION/DEMOBILIZATION**								
1.1	Mobilization/Demobilization		L.S.	1	5%	$ 81,856,000		15%	$12,278,000
	SUB-TOTAL FOR MOBILIZATION / DEMOBILIZATION						**$81,856,000**		**$12,278,000**
2	**DREDGING AND LAND RECLAMATION**								
	Total Dredge Volume (Primary and Feeder Basins)		cu.m.	975,000					
2.1	Dredging & Disposal								
	a	Excavator/Hydraulic Cutter Dredge and Upland Disposal	cu.m.	975,000	$ 160	$ 156,000,000		25%	$39,000,000
	b	Upland Disposal Environmental Mitigation (Berms, Ditching, Hydroseed, etc.)	Allowance	156,000,000	0.5%	$ 780,000		25%	$195,000
2.2	Dredging & Disposal								$0
	a	Import Fill (Sand) for Land Reclamation to El. +8.0m +/- (Subgrade Elevation)	cu.m.	0	$ 39	$ -		25%	$0
	b	Slope & Scour Protection	cu.m.	0	$ 180	$ -		25%	$0
	SUB-TOTAL FOR DREDGING AND LAND RECLAMATION						**$156,780,000**		**$39,195,000**
3	**REMOVALS AND SITE PREPARATION**								
3.1	Tree Clearance / Logging								
	a	Terminal Site	sq.m	392,000	$ 3	$ 980,000		15%	$147,000
	b	Access Roads / Utility Corridors	sq.m	39,000	$ 3	$ 97,500		15%	$14,625
3.2	Clear and Grub (Vegetation)								$0
	a	Terminal Site	sq.m	783,000	$ 1	$ 978,750		15%	$146,813
	b	Access Roads / Utility Corridors	sq.m	43,000	$ 1	$ 53,750		15%	$8,063
	SUB-TOTAL FOR REMOVALS AND SITE PREPARATION						**$2,110,000**		**$316,500**
4	**EXCAVATION AND FILL - Terminal Site**								
4.1	General Excavation (Excavate) - Assume 300mm top soil/organics etc		cu.m.	1,295,000	$ 14	$ 18,130,000		15%	$2,719,500
4.2	Rock Excavation (Drill, blast, excavate)		cu.m.	11,655,000	$ 29	$ 337,995,000		15%	$50,699,250
4.3	General Fill (600mm minus)		cu.m.	1,625,000	$ 28	$ 45,500,000		15%	$6,825,000
4.4	Haul and Dispose general excavated material		cu.m.	1,295,000	$ 10	$ 12,950,000		15%	$1,942,500
4.5	Haul and Dispose blasted rock material		cu.m.	7,252,882	$ 10	$ 72,528,824		15%	$10,879,324
	SUB-TOTAL FOR DREDGING AND LAND RECLAMATION						**$487,103,824**		**$73,065,574**
5	**WHARF STRUCTURAL**								
5.1	Concrete Caisson Wharf								
	Total Length of Wall		**lin. M**	**1,620**					
	Number of Container Berths		**ea.**	**4**					
	a	Caisson Concrete	cu.m.	167,000	$ 340	$ 56,780,000		15%	$8,517,000
	b	Caisson Re-bar	kg	26,330,000	$ 2	$ 52,660,000		15%	$7,899,000
	c	Matress Rock	tonnes	180,000	$ 25	$ 4,500,000		15%	$675,000
	d	Caisson Towing and Set-down	ea.	55	$ 128,000	$ 7,040,000		15%	$1,056,000
	e	Ballast Rock	tonnes	530,000	$ 10	$ 5,300,000		15%	$795,000
	f	Cope Beam Concrete	cu.m.	12,500	$ 398	$ 4,975,000		15%	$746,250
	g	Cope Beam Re-bar	kg	1,860,000	$ 2	$ 3,720,000		15%	$558,000
	h	Caisson Backfill (600mm minus)	tonnes	2,620,000	$ 12	$ 31,440,000		15%	$4,716,000
	i	Scour Protection	tonnes	60,000	$ 113	$ 6,750,000		15%	$1,012,500
5.2	Crane Rail System (Crane Rail, Crane Beams)								
	Length of Crane Beam		**lin. m**						
	a	CIP Concrete Front Crane Beam	cu.m.	4,000	$ 398	$ 1,592,000		10%	$159,200
	b	CIP Concrete Rear Crane Beam	cu.m.	3,900	$ 398	$ 1,552,200		10%	$155,220
	c	Crane Beam Rebar (front and rear)	kg	1,160,000	$ 2	$ 2,320,000		10%	$232,000
	d	Rear Crane Beam Granular Base	tonnes	14,000	$ 32	$ 448,000		10%	$44,800
	e	Crane Rail & Fixation	lin.m.	2,850	$ 820	$ 2,337,000		10%	$233,700
	f	Crane Rail Stops	ea.	12	$ 2,800	$ 33,600		10%	$3,360
	g	Stowage Pins	ea.	40	$ 3,800	$ 152,000		10%	$15,200
5.3	Miscellaneous Wharf Elements								
	a	Mooring System (Bollards) - Main Berths	ea.	100	$ 5,000	$ 500,000		10%	$50,000
	b	Mooring System (Bollards) - Feeder Berths	ea.	30	$ 5,000	$ 150,000		10%	$15,000
	c	Crane Power Vault	ea.	20	$ 10,000	$ 200,000		25%	$50,000
	d	Ship Service Pit	ea.	5	$ 200,000	$ 1,000,000		25%	$250,000
	e	Fenders - Main Berths	ea.	70	$ 20,000	$ 1,400,000		10%	$140,000
	f	Fenders - Feeder Berths	ea.	20	$ 20,000	$ 400,000		10%	$40,000
	SUB-TOTAL FOR WHARF STRUCTURE						**$185,249,800**		**$27,363,200**
6	**CIVIL & MISC. STRUCTURAL TERMINAL INFRASTRUCTURE**								
6.1	Civil Utilities								
	a	Fire Protection Water Distribution System (Pipes, Valves)	lin.m.	8,300	$ 260	$ 2,158,000		15%	$323,700
	b	Fire Hydrants - aboveground	ea.	50	$ 5,800	$ 290,000		15%	$43,500
	c	Fire Hydrants - underground (concrete box)	ea.	20	$ 7,600	$ 152,000		15%	$22,800
	d	Intake Pump Station for Fire Protection (Pumps, & Motors, Valves)	Allowance	1	$ 12,000	$ 12,000		15%	$1,800
	e	Domestic Water Treatment System	Allowance	1	$ 100,000	$ 100,000		15%	$15,000
	f	Domestic Water Distribution System (Mains, Services, Valves, Bends, Tees, Crosses, Pumps?)	lin.m.	4,000	$ 280	$ 1,120,000		15%	$168,000
	g	Sanitary Sewer Collection Pipes (mains, services)	lin.m.	2,200	$ 440	$ 968,000		15%	$145,200
	h	Sanitary Sewer Manholes	ea.	10	$ 6,500	$ 65,000		15%	$9,750
	i	Sanitary Sewer Pumps (manhole)	ea.	10	$ 4,800	$ 48,000		15%	$7,200
	j	Sanitary Treatment Unit and River Disposal (Anaerobic/Aerobic/UV Treatment)	Allowance	1	$ 65,000	$ 65,000		15%	$9,750
	k	Natural Runoff Water Interceptor Channel	lin.m.	0	$ 85.00	$ -		15%	$0
	l	Storm Water Collection Pipes (mains)	lin.m.	3,400	$ 440	$ 1,496,000		15%	$224,400
	m	Storm Water Manholes	ea.	40	$ 6,500	$ 260,000		15%	$39,000
	n	Storm Water Pumps	ea.	10	$ 4,800	$ 48,000		15%	$7,200
	o	Storm Water Drain Trenches (French Drains)	lin.m.	11,600	$ 180	$ 2,088,000		15%	$313,200
	p	Storm Water Treatment and River Disposal	ea.	10	$ 65,000	$ 650,000		15%	$97,500
	q	Storm Water Oil Separator	ea.	5	$ 45,000	$ 225,000		15%	$33,750
	r	Storm Water Treatment Wetland	ea.	1	$ 100,000.00	$ 100,000		15%	$15,000
	s	Utility Service Pits (for docked ships)	ea.	4	$ 25,000	$ 100,000		15%	$15,000
6.2	Civil Pavement Structures (Asphalt/Concrete, Base and Subbase Gravel)								
	a	Heavy Duty Pavement for Berth, Container Yard, Access Roads and Gate Area	sq.m.	530,000	$ 52	$ 27,560,000		10%	$2,756,000
	b	Light/Medium Duty Pavement for POV/Equipment Parking Area	sq.m.	210,000	$ 35	$ 7,350,000		10%	$735,000
	c	Gravel paving for non-trafficked areas	sq.m.	43,000	$ 15	$ 645,000		10%	$64,500
	d	RMG Concrete Runways (Container Yard)	lin.m.	15,000	$ 1,216	$ 18,240,000		10%	$1,824,000
	e	RMG Concrete Granular Base	cu. m.	48,000	$ 51	$ 2,448,000		10%	$244,800
	f	RMG Rails (Container Yard)	lin.m.	14,300	$ 820	$ 11,726,000		10%	$1,172,600
	g	RMG Rail Stops (Container Yard)	ea.	72	$ 2,800	$ 201,600		10%	$20,160
	h	RMG Stowage Pins	ea.	80	$ 3,800	$ 304,000		10%	$30,400
	i	Truck Loading Area Concrete Runways	lin.m.	550	$ 1,216	$ 668,800		10%	$66,880
	j	Truck Loading Area Concrete Granular Base	cu. m.	1,800	$ 51	$ 91,800		10%	$9,180
	k	Truck Loading Area Rails	lin.m.	500	$ 820	$ 410,000		10%	$41,000
	l	Truck Loading Area Rail Stops	ea.	4	$ 2,800	$ 11,200		10%	$1,120
	m	Truck Loading RMG Stowage Pins	ea.	20	$ 3,800	$ 76,000		10%	$7,600
	n	RMG & ASC Power Vaults	ea.	50	$ 10,000	$ 500,000		10%	$50,000
	o	Misc. Concrete Slabs (Fueling Station, Washdown Area)	sq.m.	10,800	$ 225	$ 2,430,000		10%	$243,000
	p	Misc. Concrete Strips for Container Castings	cu.m.	0	$ 900	$ -		10%	$0
6.3	Miscellaneous Civil and Structural								
	a	Fencing and Gates	lin.m.	4,000	$ 160	$ 640,000		10%	$64,000
	b	Automated Area Safety Fence	lin.m.	4,000	$ 160	$ 640,000		10%	$64,000
	c	Pavement Markings	Allowance	1	$ 80,000	$ 80,000		25%	$20,000
	d	Reefer Tower Structures	ea.	25	$ 382,500	$ 9,562,500		25%	$2,390,625
	e	Fueling / Charging Facility	L.S.	2	$ 5,900,000	$ 11,800,000		25%	$2,950,000
	f	Customs Portal Radiation Monitors (RPM)	ea.	2	$ 450,000	$ 900,000		10%	$90,000
	SUB-TOTAL FOR CIVIL TERMINAL INFRASTRUCTURE						**$106,229,900**		**$14,336,600**

ITEM	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
							%	$
7	**OFFSITE IMPROVEMENTS**							
7.1	Existing Drainage Channel Relocations	Allowance			$ -		0%	$0
7.2	Access Roads / Utility Corridors							$0
	a General Excavation (Excavate) - Assume 300mm top soil/organics etc	cu.m.	6,000	$ 14	$ 84,000		15%	$12,600
	b Rock Excavation (Drill, blast, excavate)	cu.m.	54,000	$ 29	$ 1,566,000		15%	$234,900
	c Haul and Dispose general excavated material	cu.m.	6,000	$ 10	$ 60,000		15%	$9,000
	d Haul and Dispose blasted rock material	cu.m.	27,000	$ 10	$ 270,000		15%	$40,500
	e Sub-grade - General Fill (75mm minus)	cu.m.	10,000	$ 28	$ 280,000		15%	$42,000
	f Sub-base - 75mm well graded granular material	cu.m.	13,000	$ 28	$ 364,000		15%	$54,600
	g Base - 25mm minus granular material	cu.m.	4,500	$ 57	$ 256,500		15%	$38,475
	h Asphalt	cu.m.	0	$ 45	$ -		15%	$0
7.3	Bridge Crossing	Allowance		$ 15,000,000	$ -		25%	$0
7.4	Culverts (assume 300mm CSP)	ea.	20	$ 3,200	$ 64,000		15%	$9,600
7.5	Domestic Water Distribution System (Pipes, Valves)	lin.m.	2,400	$ 280	$ 672,000		15%	$100,800
7.6	Fire Water Reserve Tank	Allowance	1	$ 500,000.00	$ 500,000		15%	$75,000
7.7	Sanitary Sewer Collection System (Pipes, MHs)	lin.m.	0	$ 465	$ -		15%	$0
SUB-TOTAL FOR OFFSITE IMPROVEMENTS						**$4,116,500**		**$617,500**
8	**GATE COMPLEX**							
8.1	Pre-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)	lane	2	$ 200,000	$ 400,000		15%	$60,000
8.2	In-Gate (Gate Arms, Cameras, Communication, Bollards, Electrical)	lane	7	$ 200,000	$ 1,400,000		15%	$210,000
8.3	Out-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)	lane	4	$ 200,000	$ 800,000		15%	$120,000
8.4	Roadside Barriers	lin.m.	500	$ 175	$ 87,500		15%	$13,125
8.5	Canopies (Pre, In and Out Gates)	sq.m.	2,400	$ 300	$ 720,000		15%	$108,000
SUB-TOTAL FOR GATE COMPLEX						**$3,407,500**		**$511,100**
9	**BUILDINGS**							
9.1	Administration Building (2 Floors)	sq.m.	3,600	$ 3,200	$ 11,520,000		10%	$1,152,000
9.2	Maintenance Building	sq.m.	3,900	$ 2,900	$ 11,310,000		10%	$1,131,000
9.3	LEED Certification (5%)	Allowance	$ 22,830,000	5%	$ 1,141,500		10%	$114,150
9.4	Gate House	sq.m.	50	$ 2,600	$ 130,000		10%	$13,000
9.5	Substation Buildings	L.S.	1	$ 532,224	$ 532,224		10%	$53,222
9.6	Compressor Building	L.S.	1	$ 268,800	$ 268,800		10%	$26,880
9.7	Wastewater Treatment Building	L.S.	1	$ 224,000	$ 224,000		10%	$22,400
9.8	Potable Water Treatment Building	L.S.	1	$ 224,000	$ 224,000		10%	$22,400
9.9	Fire Pumphouse	L.S.	1	$ 134,400	$ 134,400		10%	$13,440
9.10	Fuel Facility	L.S.	1	$ 384,000	$ 384,000		10%	$38,400
9.11	Marine Ammenities Building	L.S.	2	$ 352,000	$ 704,000		10%	$70,400
SUB-TOTAL FOR BUILDINGS						**$26,573,000**		**$2,657,300**
10	**ELECTRICAL TERMINAL INFRASTRUCTURE**							
10.1	Power Supply to Site	L.S.	1	$ 10,500,000	$ 10,500,000		25%	$2,625,000
10.2	Main Substation	ea.	1	$ 2,500,000	$ 2,500,000		25%	$625,000
10.3	Reefer Substations	ea.	2	$ 1,800,000	$ 3,600,000		25%	$900,000
10.4	RMG Substations	ea.	4	$ 1,800,000	$ 7,200,000		25%	$1,800,000
10.5	Quay Crane Substation	ea.	4	$ 1,800,000	$ 7,200,000		25%	$1,800,000
10.6	Shore Power Substation	ea.	2	$ 1,800,000	$ 3,600,000		25%	$900,000
10.7	Water In-Take Substation	ea.	1	$ 1,800,000	$ 1,800,000		25%	$450,000
10.8	Gate Electrical	L.S.	1	$ 75,000	$ 75,000		25%	$18,750
10.9	High Mast Lighting Complete (Foundation, Pole, Fixture, Conduit)	ea.	22	$ 9,500	$ 209,000		25%	$52,250
10.10	Power and Communication Distribution	L.S.	1	$ 15,000,000	$ 15,000,000		25%	$3,750,000
	a Cable Ductwork	m	10,000	$ 180.00	$ 1,800,000		15%	$270,000
	b 15 kV cable	m	100,000	$ 360.00	$ 36,000,000		15%	$5,400,000
	c Optical Fibre	m	50,000	$ 2.50	$ 125,000		15%	$18,750
SUB-TOTAL FOR ELECTRICAL TERMINAL INFRASTRUCTURE						**$51,684,000**		**$12,921,000**
11	**CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL**							
11.1	Primary Ship-to-Shore Cranes	ea.	14	$ 12,000,000	$ 168,000,000		10%	$16,800,000
11.2	Feeder Ship-to-Shore Cranes	ea.	6	$ 9,000,000	$ 54,000,000		10%	$5,400,000
11.3	Spare STS Crane Spreaders	ea.	5	$ 200,000	$ 1,000,000		10%	$100,000
11.4	Container Yard Rail Mounted Gantries	ea.	40	$ 4,815,000	$ 192,600,000		10%	$19,260,000
11.5	Truck loading RMGs	ea.	8	$ 3,000,000	$ 24,000,000		10%	$2,400,000
11.6	Automated Guided Vehicles	ea.	136	$ 1,185,000	$ 161,160,000		10%	$16,116,000
11.7	Lift Automated Guided Vehicles	ea.	8	$ 1,303,500	$ 10,428,000		10%	$1,042,800
11.8	Top-pick Container Handlers	ea.	1	$ 600,000	$ 600,000		10%	$60,000
11.9	Telehandlers	ea.	1	$ 315,000	$ 315,000		10%	$31,500
11.10	Hustler & Bombcart	ea.	2	$ 175,000	$ 350,000		10%	$35,000
11.11	Fuel/Repair Trucks	ea.	4	$ 130,000	$ 520,000		10%	$52,000
11.12	Pick-up Trucks	ea.	20	$ 45,000	$ 900,000		10%	$90,000
SUB-TOTAL FOR CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL						**$613,873,000**		**$61,387,300**
TOTAL FOR CAPITAL COST CONSTRUCTION						**$1,718,983,524**	**14%**	**$244,649,074**
TOTAL FOR CAPITAL CONSTRUCTION, INCL. CONTINGENCY						**$1,963,632,597**		
12	**PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION**							
12.1	Permitting - Allowance 10% of Construction Costs	L.S.	1,718,983,524	10%	$ 171,898,352		20%	$34,379,670
12.2	Procurement & Contract Administration at 1.5% of Purchase Price	ea.	1,718,983,524	1.5%	$ 25,784,753		20%	$5,156,951
SUB-TOTAL FOR PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION						**$197,680,000**		**$39,536,600**
TOTAL FOR PROJECT						**$1,916,700,000**	**15%**	**$284,200,000**
TOTAL FOR CONSTRUCTION, INCL. CONTINGENCY						**$2,200,900,000**		

PORT ALBERNI PORT AUTHORITY

Order of Magnitude Cost Estimate for PATH Project - Sarita Bay South OPTION A

PROJECT: PATH Pre-Feasibility Study

Date: 26-Apr-14
Prepared by: A. Smitten
Project Number: 329510
Rev: D

Fully-Automated Terminal Phase - Pre Feasibility
(2,500,000TEU's/annum)

ITEM	DESCRIPTION		UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
								%	$
1	**MOBILIZATION/DEMOBILIZATION**								
1.1	Mobilization/Demobilization		L.S.	1	5%	$ 66,550,000		15%	$9,983,000
						SUB-TOTAL FOR MOBILIZATION / DEMOBILIZATION	**$66,550,000**		**$9,983,000**
2	**DREDGING AND LAND RECLAMATION**								
	Total Dredge Volume (Primary and Feeder Basins)		cu.m.	291,000					
2.1	Dredging & Disposal								
	a	Excavator/Hydraulic Cutter Dredge and Upland Disposal	cu.m.	291,000	$ 160	$ 46,560,000		25%	$11,640,000
	b	Upland Disposal Environmental Mitigation (Berms, Ditching, Hydroseed, etc.)	Allowance	46,560,000	0.5%	$ 232,800		25%	$58,200
2.2	Dredging & Disposal								$0
	a	Import Fill (Sand) for Land Reclamation to El. +8.0m +/- (Subgrade Elevation)	cu.m.	0	$ 39	$ -		25%	$0
	b	Slope & Scour Protection	cu.m.	0	$ 180	$ -		25%	$0
						SUB-TOTAL FOR DREDGING AND LAND RECLAMATION	**$46,792,800**		**$11,698,200**
3	**REMOVALS AND SITE PREPARATION**								
3.1	Tree Clearance / Logging								
	a	Terminal Site	sq.m	704,000	$ 3	$ 1,760,000		15%	$264,000
	b	Access Roads / Utility Corridors	sq.m	39,000	$ 3	$ 97,500		15%	$14,625
3.2	Clear and Grub (Vegetation)								$0
	a	Terminal Site	sq.m	782,000	$ 1	$ 977,500		15%	$146,625
	b	Access Roads / Utility Corridors	sq.m	43,000	$ 1	$ 53,750		15%	$8,063
						SUB-TOTAL FOR REMOVALS AND SITE PREPARATION	**$2,888,750**		**$433,300**
4	**EXCAVATION AND FILL - Terminal Site**								
4.1	General Excavation (Excavate) - Assume 300mm top soil/organics etc		cu.m.	699,000	$ 14	$ 9,786,000		15%	$1,467,900
4.2	Rock Excavation (Drill, blast, excavate)		cu.m.	6,291,000	$ 29	$ 182,439,000		15%	$27,365,850
4.3	General Fill (600mm minus)		cu.m.	3,750,000	$ 28	$ 105,000,000		15%	$15,750,000
4.4	Haul and Dispose general excavated material		cu.m.	699,000	$ 10	$ 6,990,000		15%	$1,048,500
4.5	Haul and Dispose blasted rock material		cu.m.	0	$ 10	$ -		15%	$0
						SUB-TOTAL FOR DREDGING AND LAND RECLAMATION	**$304,215,000**		**$45,632,250**
5	**WHARF STRUCTURAL**								
5.1	Concrete Caisson Wharf								
	Total Length of Wall		**lin. M**	**1,720**					
	Number of Container Berths		**ea.**	**4**					
	a	Caisson Concrete	cu.m.	152,000	$ 340	$ 51,680,000		15%	$7,752,000
	b	Caisson Re-bar	kg	24,050,000	$ 2	$ 48,100,000		15%	$7,215,000
	c	Matress Rock	tonnes	165,000	$ 25	$ 4,125,000		15%	$618,750
	d	Caisson Towing and Set-down	ea.	58	$ 128,000	$ 7,424,000		15%	$1,113,600
	e	Ballast Rock	tonnes	490,000	$ 10	$ 4,900,000		15%	$735,000
	f	Cope Beam Concrete	cu.m.	11,480	$ 398	$ 4,569,040		15%	$685,356
	g	Cope Beam Re-bar	kg	1,710,000	$ 2	$ 3,420,000		15%	$513,000
	h	Caisson Backfill (600mm minus)	tonnes	2,350,000	$ 12	$ 28,200,000		15%	$4,230,000
	i	Scour Protection	tonnes	53,000	$ 113	$ 5,962,500		15%	$894,375
5.2	Crane Rail System (Crane Rail, Crane Beams)								
	Length of Crane Beam		**lin. m**						
	a	CIP Concrete Front Crane Beam	cu.m.	3,700	$ 398	$ 1,472,600		10%	$147,260
	b	CIP Concrete Rear Crane Beam	cu.m.	4,100	$ 398	$ 1,631,800		10%	$163,180
	c	Crane Beam Rebar (front and rear)	kg	1,160,000	$ 2	$ 2,320,000		10%	$232,000
	d	Rear Crane Beam Granular Base	tonnes	15,000	$ 32	$ 480,000		10%	$48,000
	e	Crane Rail & Fixation	lin.m.	2,850	$ 820	$ 2,337,000		10%	$233,700
	f	Crane Rail Stops	ea.	12	$ 2,800	$ 33,600		10%	$3,360
	g	Stowage Pins	ea.	40	$ 3,800	$ 152,000		10%	$15,200
5.3	Miscellaneous Wharf Elements								
	a	Mooring System (Bollards) - Main Berths	ea.	100	$ 5,000	$ 500,000		10%	$50,000
	b	Mooring System (Bollards) - Feeder Berths	ea.	70	$ 5,000	$ 350,000		10%	$35,000
	c	Crane Power Vault	ea.	20	$ 10,000	$ 200,000		25%	$50,000
	d	Ship Service Pit	ea.	5	$ 200,000	$ 1,000,000		25%	$250,000
	e	Fenders - Main Berths	ea.	70	$ 20,000	$ 1,400,000		10%	$140,000
	f	Fenders - Feeder Berths	ea.	50	$ 20,000	$ 1,000,000		10%	$100,000
						SUB-TOTAL FOR WHARF STRUCTURE	**$171,257,540**		**$25,224,800**
6	**CIVIL & MISC. STRUCTURAL TERMINAL INFRASTRUCTURE**								
6.1	Civil Utilities								
	a	Fire Protection Water Distribution System (Pipes, Valves)	lin.m.	8,300	$ 260	$ 2,158,000		15%	$323,700
	b	Fire Hydrants - aboveground	ea.	50	$ 5,800	$ 290,000		15%	$43,500
	c	Fire Hydrants - underground (concrete box)	ea.	20	$ 7,600	$ 152,000		15%	$22,800
	d	Intake Pump Station for Fire Protection (Pumps, & Motors, Valves)	Allowance	1	$ 12,000	$ 12,000		15%	$1,800
	e	Domestic Water Treatment System	Allowance	1	$ 100,000	$ 100,000		15%	$15,000
	f	Domestic Water Distribution System (Mains, Services, Valves, Bends, Tees, Crosses, Pumps?)	lin.m.	4,000	$ 280	$ 1,120,000		15%	$168,000
	g	Sanitary Sewer Collection Pipes (mains, services)	lin.m.	2,200	$ 440	$ 968,000		15%	$145,200
	h	Sanitary Sewer Manholes	ea.	10	$ 6,500	$ 65,000		15%	$9,750
	i	Sanitary Sewer Pumps (manhole)	ea.	10	$ 4,800	$ 48,000		15%	$7,200
	j	Sanitary Treatment Unit and River Disposal (Anaerobic/Aerobic/UV Treatment)	Allowance	1	$ 65,000	$ 65,000		15%	$9,750
	k	Natural Runoff Water Interceptor Channel	lin.m.	0	$ 85.00	$ -		15%	$0
	l	Storm Water Collection Pipes (mains)	lin.m.	3,400	$ 440	$ 1,496,000		15%	$224,400
	m	Storm Water Manholes	ea.	40	$ 6,500	$ 260,000		15%	$39,000
	n	Storm Water Pumps	ea.	10	$ 4,800	$ 48,000		15%	$7,200
	o	Storm Water Drain Trenches (French Drains)	lin.m.	11,600	$ 180	$ 2,088,000		15%	$313,200
	p	Storm Water Treatment and River Disposal	ea.	10	$ 65,000	$ 650,000		15%	$97,500
	q	Storm Water Oil Separator	ea.	5	$ 45,000	$ 225,000		15%	$33,750
	r	Storm Water Treatment Wetland	ea.	1	$ 100,000.00	$ 100,000		15%	$15,000
	s	Utility Service Pits (for docked ships)	ea.	4	$ 25,000	$ 100,000		15%	$15,000
6.2	Civil Pavement Structures (Asphalt/Concrete, Base and Subbase Gravel)								
	a	Heavy Duty Pavement for Berth, Container Yard, Access Roads and Gate Area	sq.m.	530,000	$ 52	$ 27,560,000		10%	$2,756,000
	b	Light/Medium Duty Pavement for POV/Equipment Parking Area	sq.m.	210,000	$ 35	$ 7,350,000		10%	$735,000
	c	Gravel paving for non-trafficked areas	sq.m.	40,000	$ 15	$ 600,000		10%	$60,000
	d	RMG Concrete Runways (Container Yard)	lin.m.	15,000	$ 1,216	$ 18,240,000		10%	$1,824,000
	e	RMG Concrete Granular Base	cu. m.	48,000	$ 51	$ 2,448,000		10%	$244,800
	f	RMG Rails (Container Yard)	lin.m.	14,300	$ 820	$ 11,726,000		10%	$1,172,600
	g	RMG Rail Stops (Container Yard)	ea.	72	$ 2,800	$ 201,600		10%	$20,160
	h	RMG Stowage Pins	ea.	80	$ 3,800	$ 304,000		10%	$30,400
	i	Truck Loading Area Concrete Runways	lin.m.	550	$ 1,216	$ 668,800		10%	$66,880
	j	Truck Loading Area Concrete Granular Base	cu. m.	1,800	$ 51	$ 91,800		10%	$9,180
	k	Truck Loading Area Rails	lin.m.	500	$ 820	$ 410,000		10%	$41,000
	l	Truck Loading Area Rail Stops	ea.	4	$ 2,800	$ 11,200		10%	$1,120
	m	Truck Loading RMG Stowage Pins	ea.	20	$ 3,800	$ 76,000		10%	$7,600
	n	RMG & ASC Power Vaults	ea.	50	$ 10,000	$ 500,000		10%	$50,000
	o	Misc. Concrete Slabs (Fueling Station, Washdown Area)	sq.m.	10,800	$ 225	$ 2,430,000		10%	$243,000
	p	Misc. Concrete Strips for Container Castings	cu.m.	0	$ 900	$ -		10%	$0
6.3	Miscellaneous Civil and Structural								
	a	Fencing and Gates	lin.m.	4,000	$ 160	$ 640,000		10%	$64,000
	b	Automated Area Safety Fence	lin.m.	4,000	$ 160	$ 640,000		10%	$64,000
	c	Pavement Markings	Allowance	1	$ 80,000	$ 80,000		25%	$20,000
	d	Reefer Tower Structures	ea.	25	$ 382,500	$ 9,562,500		25%	$2,390,625
	e	Fueling / Charging Facility	L.S.	2	$ 5,900,000	$ 11,800,000		25%	$2,950,000
	f	Customs Portal Radiation Monitors (RPM)	ea.	2	$ 450,000	$ 900,000		10%	$90,000
						SUB-TOTAL FOR CIVIL TERMINAL INFRASTRUCTURE	**$106,184,900**		**$14,332,100**

ITEM	DESCRIPTION		UNITS	ESTIMATED QUANTITY	UNIT RATE	ITEM COST	AREA COST	CONTINGENCY	
								%	$
7	**OFFSITE IMPROVEMENTS**								
7.1	Existing Drainage Channel Relocations		Allowance			$ -		0%	$0
7.2	Access Roads / Utility Corridors								$0
	a	General Excavation (Excavate) - Assume 300mm top soil/organics etc	cu.m.	6,000	$ 14	$ 84,000		15%	$12,600
	b	Rock Excavation (Drill, blast, excavate)	cu.m.	54,000	$ 29	$ 1,566,000		15%	$234,900
	c	Haul and Dispose general excavated material	cu.m.	6,000	$ 10	$ 60,000		15%	$9,000
	d	Haul and Dispose blasted rock material	cu.m.	27,000	$ 10	$ 270,000		15%	$40,500
	e	Sub-grade - General Fill (75mm minus)	cu.m.	10,000	$ 28	$ 280,000		15%	$42,000
	f	Sub-base - 75mm well graded granular material	cu.m.	13,000	$ 28	$ 364,000		15%	$54,600
	g	Base - 25mm minus granular material	cu.m.	4,500	$ 57	$ 256,500		15%	$38,475
	h	Asphalt	cu.m.	0	$ 45	$ -		15%	$0
7.3	Bridge Crossing		Allowance		$ 15,000,000	$ -		25%	$0
7.4	Culverts (assume 300mm CSP)		ea.	20	$ 3,200	$ 64,000		15%	$9,600
7.5	Domestic Water Distribution System (Pipes, Valves)		lin.m.	2,400	$ 280	$ 672,000		15%	$100,800
7.6	Fire Water Reserve Tank		Allowance	1	$ 500,000.00	$ 500,000		15%	$75,000
7.7	Sanitary Sewer Collection System (Pipes, MHs)		lin.m.	0	$ 465	$ -		15%	$0
						SUB-TOTAL FOR OFFSITE IMPROVEMENTS	**$4,116,500**		**$617,500**
8	**GATE COMPLEX**								
8.1	Pre-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)		lane	2	$ 200,000	$ 400,000		15%	$60,000
8.2	In-Gate (Gate Arms, Cameras, Communication, Bollards, Electrical)		lane	7	$ 200,000	$ 1,400,000		15%	$210,000
8.3	Out-Gate OCR (Gate Arms, OCR, Cameras, Communication, Bollards, Electrical)		lane	4	$ 200,000	$ 800,000		15%	$120,000
8.4	Roadside Barriers		lin.m.	500	$ 175	$ 87,500		15%	$13,125
8.5	Canopies (Pre, In and Out Gates)		sq.m.	2,400	$ 300	$ 720,000		15%	$108,000
						SUB-TOTAL FOR GATE COMPLEX	**$3,407,500**		**$511,100**
9	**BUILDINGS**								
9.1	Administration Building (2 Floors)		sq.m.	3,600	$ 3,200	$ 11,520,000		10%	$1,152,000
9.2	Maintenance Building		sq.m.	3,900	$ 2,900	$ 11,310,000		10%	$1,131,000
9.3	LEED Certification (5%)		Allowance	$ 22,830,000	5%	$ 1,141,500		10%	$114,150
9.4	Gate House		sq.m.	50	$ 2,600	$ 130,000		10%	$13,000
9.5	Substation Buildings		L.S.	1	$ 532,224	$ 532,224		10%	$53,222
9.6	Compressor Building		L.S.	1	$ 268,800	$ 268,800		10%	$26,880
9.7	Wastewater Treatment Building		L.S.	1	$ 224,000	$ 224,000		10%	$22,400
9.8	Potable Water Treatment Building		L.S.	1	$ 224,000	$ 224,000		10%	$22,400
9.9	Fire Pumphouse		L.S.	1	$ 134,400	$ 134,400		10%	$13,440
9.10	Fuel Facility		L.S.	1	$ 384,000	$ 384,000		10%	$38,400
9.11	Marine Ammenities Building		L.S.	2	$ 352,000	$ 704,000		10%	$70,400
						SUB-TOTAL FOR BUILDINGS	**$26,573,000**		**$2,657,300**
10	**ELECTRICAL TERMINAL INFRASTRUCTURE**								
10.1	Power Supply to Site		L.S.	1	$ 10,500,000	$ 10,500,000		25%	$2,625,000
10.2	Main Substation		ea.	1	$ 2,500,000	$ 2,500,000		25%	$625,000
10.3	Reefer Substations		ea.	2	$ 1,800,000	$ 3,600,000		25%	$900,000
10.4	RMG Substations		ea.	4	$ 1,800,000	$ 7,200,000		25%	$1,800,000
10.5	Quay Crane Substation		ea.	4	$ 1,800,000	$ 7,200,000		25%	$1,800,000
10.6	Shore Power Substation		ea.	2	$ 1,800,000	$ 3,600,000		25%	$900,000
10.7	Water In-Take Substation		ea.	1	$ 1,800,000	$ 1,800,000		25%	$450,000
10.8	Gate Electrical		L.S.	1	$ 75,000	$ 75,000		25%	$18,750
10.9	High Mast Lighting Complete (Foundation, Pole, Fixture, Conduit)		ea.	22	$ 9,500	$ 209,000		25%	$52,250
10.10	Power and Communication Distribution		L.S.	1	$ 15,000,000	$ 15,000,000		25%	$3,750,000
	a	Cable Ductwork	m	10,000	$ 180.00	$ 1,800,000		15%	$270,000
	b	15 kV cable	m	100,000	$ 360.00	$ 36,000,000		15%	$5,400,000
	c	Optical Fibre	m	50,000	$ 2.50	$ 125,000		15%	$18,750
						SUB-TOTAL FOR ELECTRICAL TERMINAL INFRASTRUCTURE	**$51,684,000**		**$12,921,000**
11	**CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL**								
11.1	Primary Ship-to-Shore Cranes		ea.	14	$ 12,000,000	$ 168,000,000		10%	$16,800,000
11.2	Feeder Ship-to-Shore Cranes		ea.	6	$ 9,000,000	$ 54,000,000		10%	$5,400,000
11.3	Spare STS Crane Spreaders		ea.	5	$ 200,000	$ 1,000,000		10%	$100,000
11.4	Container Yard Rail Mounted Gantries		ea.	40	$ 4,815,000	$ 192,600,000		10%	$19,260,000
11.5	Truck loading RMGs		ea.	8	$ 3,000,000	$ 24,000,000		10%	$2,400,000
11.6	Automated Guided Vehicles		ea.	136	$ 1,185,000	$ 161,160,000		10%	$16,116,000
11.7	Lift Automated Guided Vehicles		ea.	8	$ 1,303,500	$ 10,428,000		10%	$1,042,800
11.8	Top-pick Container Handlers		ea.	1	$ 600,000	$ 600,000		10%	$60,000
11.9	Telehandlers		ea.	1	$ 315,000	$ 315,000		10%	$31,500
11.10	Hustler & Bombcart		ea.	2	$ 175,000	$ 350,000		10%	$35,000
11.11	Fuel/Repair Trucks		ea.	4	$ 130,000	$ 520,000		10%	$52,000
11.12	Pick-up Trucks		ea.	20	$ 45,000	$ 900,000		10%	$90,000
						SUB-TOTAL FOR CONTAINER HANDLING EQUIPMENT FOR FULLY-AUTOMATED TERMINAL	**$613,873,000**		**$61,387,300**
						TOTAL FOR CAPITAL COST CONSTRUCTION	**$1,397,542,990**	**13%**	**$185,397,850**
						TOTAL FOR CAPITAL CONSTRUCTION, INCL. CONTINGENCY		**$1,582,940,840**	
12	**PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION**								
12.1	Permitting - Allowance 10% of Construction Costs		L.S.	1,397,542,990	10%	$ 139,754,299		20%	$27,950,860
12.2	Procurement & Contract Administration at 1.5% of Purchase Price		ea.	1,397,542,990	1.5%	$ 20,963,145		20%	$4,192,629
						SUB-TOTAL FOR PERMITTING, ENGINEERING, CONTRACT ADMINISTRATION	**$160,720,000**		**$32,143,500**
						TOTAL FOR PROJECT	**$1,558,300,000**	**14%**	**$217,500,000**
						TOTAL FOR CONSTRUCTION, INCL. CONTINGENCY		**$1,775,800,000**	