THE WEST COAST
REGIONAL COUNCIL

EXTRAORDINARY MEETING OF

THE GREYMOUTH JOINT FLOODWALL COMMITTEE

ON

MONDAY 5 SEPTEMBER 2022, AT 3:00PM

In Council Chambers, West Coast Regional Council and via zoom

AGENDA

1. Welcome
2. Apologies
3. Coastal Inundation
4. General Business

Report to: Greymouth Floodwall Joint Committee	**Meeting Date:** 5 September 2022
Title of Item: Coastal Inundation	
Report by: Rachel Vaughan, Acting Planning and Science Manager	
Reviewed by: Heather Mabin, CEO	
Public excluded? No	

Report Purpose

To update the Committee on Coastal Inundation modelling and highlight the localised effects of this hazard risk

Draft Recommendations

It is recommended that the committee resolve to:

1. *Receive the report.*

2. *Recommend that the Committee direct the Regional Council to consult with the Rating District on funding investigations into storm frequency and extent of coastal inundation in the Cobden area.*

Issues and Discussion

Coastal inundation was felt by residents in Cobden from the storm event on 13 June 2022. Dommett Esplanade in Cobden was left strewn with debris and damaged fences as strong winds and high seas from a low-pressure weather system caused waves to overtop at the North end of the Cobden sea wall. Seawater overtopped at Dommett Esplanade and North Beach Road, with properties damaged and Dommett Esplanade closed between Kettle and Ward Street.

The Cobden Seawall has been breached in the past, see Appendix 1 for Collated Historic Cobden Seawall Inundation Information September 2022.

The history of the seawall structure varies along the length. In 1998 resource consent was obtained to increase the height of the seawall structure to protect the road. these consents were for a period of 35 years. Appendix 2 contains copies of these documents.

The 13 June 2022 event overtopping appeared to be in a northwest direction, with residents reporting that water was running from North Beach Road. There was limited observed effect on the levels of the Grey River due to no monitoring gauges in this location. The nearest tidal gauge is at Charleston, however, these gauge levels reflect a increased sea levels on 13 June 2022, in addition to the Metservice forecast for sea levels during the period

None of the previous meeting minutes from this Joint Committee reflect the conversations that were held around forming a strategy for including coastal protection. Previous conversations were limited to sea inundation worsening flood flows at the river stopbanks. The issue of sea level rise worsening flood flows at the river stopbank was discussed in March 2021 by the Committee. Cobden coastal inundation modelling was undertaken by Land River Sea Consulting Ltd and presented on 19 March 2021.

This Cobden Coastal Inundation Modelling report is attached in Appendix 3, and the purpose was to present options for a seawall at Jellyman Park:

> Results show that under existing sea levels and with the existing coastline still intact, we can expect that the current defences will be sufficient to prevent inundation under a a 10% AEP event, even if the unlined section of bank is breached. However, if a 1% AEP stormtide occurs, then we can expect inundation of a significant number of properties. It the unlined section of bank also breaches, then the number of properties inundated will increase even further and flood depths will be greater.

The report further notes:

> … the southernmost section of the wall in front of Jellyman park is well formed and in good condition, however moving northwards, the wall deteriorates in condition significantly with the northern most section of wall being nothing more than a gravel bund that would collapse immediately were it put under any pressure from the sea.

An Options report for Jellyman Park Seawall was also presented to the March 2021 meeting see Appendix 4. While the costs are estimated, the option recommendations from the report remain. The existing seawall further north along the esplanade was not considered at the time (only the area shown in the plans). The Committee agreed at that meeting to consult on the following:

Consultation options:	The committee agreed that option one is the preferred option. WCRC will consult on extending the rating district from North Beach to Saltwater Creek. GDC to consult on future use Jellyman Park in the next annual plan process. Short term maintenance/emergency works will be managed collectively as required over a 12-month period while consultation takes place.

The Cobden Coastal Inundation Modelling report was to consider only a portion of seawall that was relevant to the Greymouth Rating District. This was because the rating district was set-up for river flooding, not coastal inundation/erosion purposes. See Asset Management Plan in Appendix 5.

Should the Committee wish to pursue an extended seawall option, the discussions need to be had on:

- Additional surveying and modelling to ascertain the extent of such a seawall to benefit the Community
- The cost to construct a seawall and maintenance on any existing coastal protection assets.
- How both the investigations and proposed capital infrastructure would be funded

In addition to this report, Appendix 3 contains modeling for seawater inundation in the event of sea height causing a breach at the north end of the current sea wall. See the modelling for a 1% Stormtide, and 1% Stormtide with 0.5 Sealevel rise.

The modelling shows the area in Cobden that receives flooding during high sea inundation. This is consistent with the relatively isolated flooding that occurred after the 13 June 2022 event. This map does not reflect wave energy predict storm surge heights or frequency. Independent modelling by coastal experts would need to carry out coastal modelling and data analysis to indicate frequency and risk of occurrence. This work may give an indication of risk of frequency and extent of coastal inundation occurrence to the Community.

Other considerations for the Committee to consider seawall protection:

- that Rating District would need to agree to alter their Asset Management Plan, or
- consult on setting up another Rating District, or
- a targeted rate for those that benefit from a sea wall, for example, the properties shown in the inundation maps.

Noting that there are only a small number of properties that would have an advantage from any coastal protection works. The members of the Rating District would need to consider if it is economical and fair for the wider rating to support a seawall proposal for Cobden. See the inundation maps in Appendix 2 and the area that suffers inundation from Storm surge events.

Additional note for the Committee is that there is now a level recorder at Cobden, which will better capture observed storm surge events on water levels.
See:https://envirodata.wcrc.govt.nz/dashboards/riverlevels/riverlevels.php#1

Conclusion

The Committee will need to decide if they wish to consult with the wider rating district and seek approval of the landowners for further investigations into options and how to fund the these investigations.

The Committee would need to consult with the Rating District on options to investigate and fund both the investigation and capital works for a seawall. Consultation would include agreement to significantly alter the Asset Management Plan or consult on setting up another Rating District, or targeted rates for those that benefit from the sea wall.

Attachments

Attachment 1: Request for Meeting of Greymouth Joint Floodwall Committee
Attachment 2: Collated Historic Cobden Seawall Inundation Information September 2022
Attachment 3: Resource consent document dated 26 May 1998
Attachment 4: Resource consent document dated 26 November 2001
Attachment 5: Cobden Coastal Inundation Modelling was undertaken by Land River Sea Consulting Ltd
Attachment 6: Options Report for River Wall for Coastal Inundation dated 5 July 2022
Attachment 7: Greymouth Asset Management Plan 2021-2024
Attachment 8: Cobden Sea Inundation Modelling - 1%StormTide
Attachment 9: Cobden Sea Inundation Modelling - 1%StormTide +0.5M Sea Level Rise

MĀWHERA
GREY
DISTRICT COUNCIL

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Tel 03 769 8600
info@greydc.govt.nz
www.greydc.govt.nz

19 August 2022

Heather Mabin
Chief Executive
West Coast Regional Council

Dear Heather

I wish to formally request that an Extraordinary Meeting of the Greymouth Joint Floodwall Committee is arranged. The nature of the business of this extraordinary meeting is to discuss options for affected residents in Cobden following recent flood / high sea inundation.

I am proposing the date of Friday 26 August 2022, at 3.00pm in the Council Chambers at the West Coast Regional Council. Please confirm that your venue is available.

As per cl.22 (1) Schedule 7, LGA 2002, I have included the signatures Cr Tim Mora and Cr Murray Hay as members of the Greymouth Joint Floodwall committee.

Kind regards

Tania Gibson	**Tim Mora**	**Murray Hay**
Grey District Mayor	Grey District Councillor	Grey District Councillor

Collated Historic Cobden Seawall Inundation Information September 2022

Although breaching many times prior to 1968, when the protective bank along Beach Road was again inundated, an emergency meeting of the Greymouth Borough Council was held and the decision made to go ahead with building a 'breakwater'. The Borough Council handed the work over to the Westland Catchment Board (Henry Clarke).

In October 1969 works on a protective seawall along a section of Domett Esplanade were underway. The budget for the work was $10,000. It was designed to be 11 chains long, using 3200 tonnes of heavy armour rock (up to 24 tonne rocks) from Cobden Quarry. A 6ft deep 20ft wide trench was bulldozed then filled with heavy rock to a height of '8ft or so' above road level. A National Roads Board subsidy of four to one would be sought.

In 1975 rock was again carted to Domett Esplanade when a section of the wall breached

SEA FOAM covering the street frontage at North Beach, this morning, as the sea raced in at high tide. At one period it threatened a house close to the thoroughfare.—(Inkster photo).

Greymouth Evening Star, Thursday, October 1, 1959

Wildcat Strike And Hollywood Star Divert Voters

LOND

A wildcat strike and Miss Jayne Mansfield yester became the latest General Election issues to divert the atten of British voters from the loftier vistas of who should repre Britain at the "summit."

Conservative leaders on Tuesday night sent out a cal their candidates to plug the Government's record in in national affairs as the main campaign topic.

But yesterday's unofficial strike of 1,500 British oxy company workers, threatening to shut down the car indus wiped world affairs off the front pages.

Labour chiefs feared the public would blame Socialists for the strike.

Miss Mansfield, the Holly-wood star, wearing a tight scar-let dress, became involved in the election by being chosen by a

eurin Bevan at Reading an threatened to "debag" hi (take off his trousers).

Conservative papers c plained that at a meeting be this incident Mr Bevan called Conservative lead

October 1959

1st Oct 1959

High Seas Inundate North Beach Road Near Metal Crusher

Cobden's North Beach, the scene of considerable damage a fortnight or so ago, when spring tides pounded the foreshore supported by high winds and rain and then undermined and destroyed a company-owned crushing plant, is again being subjected to lashing seas of greater intensity than before.

High seas, whipped by gale-force winds and rain last night, broke across the road and flowed into the isolated property of Mr E. Boland, which lies about six chains from the normal high tide mark. Even last month's spring tides failed to encroach so far.

Damage has been done to the road, and about two chains are completely inundated by dirty sea foam, which lies at varying depth of between 18in and 2ft.

This morning there was abundant evidence of how far the sea had encroached on to the Boland property. Debris, driftwood and other flotsam lay scattered over the front area—once a garden, but now covered by several inches of silt.

From the front room of the Boland house huge rollers could be seen breaking against the road embankment two chains away, while further south the waves were actually crossing the road and entering the sea-front paddocks of Mr M. J. Minehan's farm property.

WORST EVER

Mr Minehan, who has lived in the area for many years, and whose house lies about eight or nine chains behind Mr Boland's, but is on higher ground, said the seas were the worst he had ever seen.

"I think something will have to be done," he told the Evening Star. He described the sea as at an "all-time high".

At a point farther north, beyond the Boland home, the sea has crossed the road, poured through the West Coast Acclimatisation Society's game farm, and run into Lake Ryan, a small fresh-water lake under the society's control.

Mr Boland's residence is the only one adversely affected by the high seas, as it is at the closest point to the sea of any residence in the immediate vicinity. Mrs Boland said it was the highest she had ever seen the waves. Last night the sea had encroached to the second step of the front verandah, but had not entered the house.

Driftwood lay piled on the southern side of the house, and Mrs Boland said her husband had had to remove a large length of steel from the gateway before he could get his car out. "It took him all his time to move it," she said, which amply illustrated the force of the waves.

The tar-sealed road approaching the property's frontage has been completely covered with debris and flotsam as well as large rocks and boulders from the shingle-covered beach.

The whole area, in fact, has, within the space of 12 hours, been transformed from a scenic drive to a desolate-looking wilderness.

PRECARIOUS LEAN

The screening and crushing plant building of the crushing company some yards north, from which all essential machinery and equipment were salvaged following high spring tides that swept most of the buildings away, has taken on a precarious lean, and, said Mr Minehan, could be expected to "go anytime". The building has been abandoned by the company.

PEAK TIDE

Mrs Boland explained that the peak tide last night occurred after the scheduled high tide. The Bolands had watched the waves break across the road and enter their property, but there was little that could be done to prevent it.

Prior to last month's spring tide's the high water mark was some distance from the road embankment, but since then repeated high tides have gradually extended toward the road until, now, they reach the bottow of the road embankment.

Last night a section of the road, about two yards across, and just south of Mr Boland's residence, was washed out. This morning further scouring was evident almost straight opposite the house.

TRAFFIC BARRIER

The flotsam lying across the North Beach Road made it impossible for traffic to get past. The thick, dark foam completely concealed the state of the road, but large pieces of timber and sharp rocks poked ominously from the fluffy bed, ample evidence of what might have lain concealed beneath.

These conditions prevailed for about two chains, and provided a most effective traffic barrier. At least four cars were noticed to turn back to Greymouth within half an hour—one of the motorists was a doctor.

Mrs Boland said she did not expect the sea would encroach as far as it had last night, but a close watch is being kept for any signs of a recurrence.

At 11.30 a.m., however, Mrs Minehan reported that the position had improved, and the sea had stopped breaking over the road.

Westland Gets

Gray Star 21/8/2019

WEST COAST YESTERYEAR 1969

A crash $10,000 programme to arrest sea erosion in Cobden will be mounted by the Greymouth Borough Council.

A 10-chain frontage of rock work will be placed along the sea front of Domett Esplanade in Cobden where the sea has been regularly breaking over in recent weeks.

Selected rock will be used in the project for which a National Roads Board subsidy of four to one will be sought.

Cr W G McKay: Where are you getting the rock from?

"The Cobden quarry."

Cr McKay: "It is rubbish."

The Borough Council's acting engineer, Mr R L Trainor, said that this had been the advice of the Ministry of Works and the Catchment Board and the rock would be selected.

Cr Mc Kay" It is still rubbish."

Cr McKay who is a former MOW engineer, said it was open to doubt if a solid wall would be a success but he made the points only as suggestions.

" If you have the advice of experts, I suppose," he said.

The councilor to works Cr T A Bird, said this was the plan put forward by the Catchment Board.

Erosion was worse now than it ever was and it was a question of getting the job done quickly before the worst happened.

"I still have my doubts," Cr MacKay said.

Heavy Sea Breaks P

Bank At Cobden

The protective bank along the Beach Road at Cobden facing the sea has been battered down to road level in some places by the rough sea last night and this morning.

Early last night the sea, backed by strong winds broke over the protective bank and threw some large pieces of drift-wood and other smaller debris over the bank and on to the road.

At 10 p.m. it was more than a foot high in some places and residents in the area were forced to take alternative routes or work their way slowly through the driftwood and water.

One resident said that the sea was eating into the protective bank, which has already taken a hiding from the huge waves, and in future any heavy sea will flood the area if the bank is not rebuilt.

"I don't think I'd like to live where this has occurred."

He said that, so far, the flooding had been more of a nuisance to residents than a danger.

"But that's this time. There could be a bigger sea in the future and then it could be a different story.

He said that work on the bank was one thing the Borough Council would have to do iin the near future to make sure there was no danger from further heavy seas.

This morning Borough Council workers began cleaning up the debris left by the flood.

Shortly after this job was done the area was flooded again and they are repeating their work this afternoon.

Acting-engineer of the Greymouth Borough Council, Mr R. L. Trainor, said today he had inspected the area to find out what damage had been caused.

He said it was not as bad as the flooding that had occurred about six weeks ago.

"With spring tides coming up in the next few days there could be considerable more flooding as the beach and protective banks have been completely washed away in some parts."

He said it had flooded again this morning about 9.30 a.m. and workers had cleared up the mess since then.

He said the wind had changed this morning and the flooding was not as bad as it had been last night.

North Vietn

D.M.Z. To S

DA NANG (South Vietnam), troops have infiltrated across the Johnson's bombing halt warnings,

"They don't take notice of the bombing halt. They are still moving south," General Hoang Xuan Lan, 39-year-old military commander in the northern zone, told a press conference yesterday.

He revealed that South Vietnamese troops in the five northern-most provinces were on full alert because of indications that the North Vietnamese and Viet Cong had launched a winter campaign of terrorism and sabotage.

Twelve miles south of Da Nang, South Vietnamese troops have killed 253 North Vietnamese in a big battle, a military spokesman claimed.

General Lam said North Vietnamese troops in platoon and company strength—between 30 and 130 men—had infiltrated across the zone, apparently to re-supply North Vietnamese units in South Vietnam.

D.M.Z. ATTACK

U.S. military headquarters said American fighter-bombers attacked a North Vietnamese bunker complex a half mile inside the D.M.Z. on Sunday.

Five enemy soldiers were reported killed and nine bunkers destroyed, the Associated Press reported.

1969

EXPLOSIONS NEXT WEEK—

Start In Quarry For Cobden Breakwater

Greymouth will echo with explosions next week as contractors begin blowing rock from the Cobden quarry for the Domett Esplanade breakwater.

The Borough Council has handed the job over to the Westland Catchment Board whose engineer, Mr H. E. Clarke, said this morning that work may begin today.

Carting of the rock for the $10,000 breakwater will begin next week.

Mr Clarke said the work would be done by M. Langridge and Sons and would be finished inside a month.

CONFIDENT

Severe flooding and the displacement of spoil across Domett Esplanade occurred regularly over the past two months.

An emergency meeting of the Greymouth Borough Council decided to go ahead with the building of a breakwater after the last series of flooding.

Mr Clarke told the Evening Star this morning that he was confident the wall to be built will contain the sea.

The size of rock used will only be limited by the size and capacity of the transporters to be used.

"We will dig down six feet in parts for the toe rock which will be the biggest," said Mr Clarke.

The wall will be about 10 feet high and consist of "graded" quarry rock.

Largest will be of eight tons and upwards down to the smaller pieces to "plug the gaps."

BLASTING

The heavier toe rock will take the initial brunt of the sea.

When asked his opinion of the strength of the work and whether it would be successful in keeping out the sea, Mr Clarke said that similar work some years ago at the mouth of the Hokitika River had been completely successful.

The rock from the Cobden quarry will be won by blasting "so you should get a few booms," said Mr Clarke.

Mr Clarke does not expect weather to interfere with the project.

Bottomless Trial Judge Is Slated

SACRAMENTO (California), Oct. 2 (N.Z.P.A.)—A district attorney said today that Municipal Judge Earl Warren Jr., son of the former U.S. Supreme Court Chief Justice, did not understand the law because a jury in Warren's court acquitted two nude dancers of indecent exposure and lewd conduct, United Press International reported.

"He sent them out and literally railroaded them," District Attorney John Price said. "Some of the jurors I talked to thought they were forced into this."

Asked if he would continue to prosecute nude or nearly nude "bottomless" dancers in Sacramento, he said: "You'd better believe it. I assume if we get a judge who understands the law we'll get a better shake."

The jury first deliberated 11 hours to find Sheila Brendenson and Suzanne Haines, both 22, guilty of indecent exposure but innocent of lewd and dissolute conduct for their stark naked dance in the Pink Pussy Kat beer bar.

But Warren sent the panel back to deliberate again, telling them if the Go-Go dancers were guilty of the first charge, they also had to be guilty of the second, or, he said, they should be acquitted of both.

October 1969

GIANT ROCKS v GIANT SEAS

Work on a protective sea-wall along a section of Domett Esplanade, Cobden, should be completed within two weeks, according to the engineer of Westland Catchment Board, Mr Henry Clarke.

Rocks weighing up to 24 tons are going into the construction.

The new sea-wall became necessary after unusually big seas last May and again in August hurtled over the existing beach front, flooding a length of Domett Esplanade road and threatening a dozen or so nearby homes. On some sections seawater reached within a few feet of the front doors of homes.

"This was an urgent job. And the only permanent urgent job of this nature is a heavy rock protective embankment," the board's engineer said.

Length of the new sea-wall when finished will be 11 chains, taking a total of 3200 tons of heavy rocks, quarried at the Cobden quarry. Cost of the job has been estimated at $10,000.

"Scour is the main problem," said Mr Clarke.

He said to combat this, a 6ft-deep and 20ft-wide trench was first being bulldozed on the beach front bordering the road and then filled with heavy rock. With this as a base, further heavy rock was being piled along the 11-chain length up to a height of eight or so feet above road level.

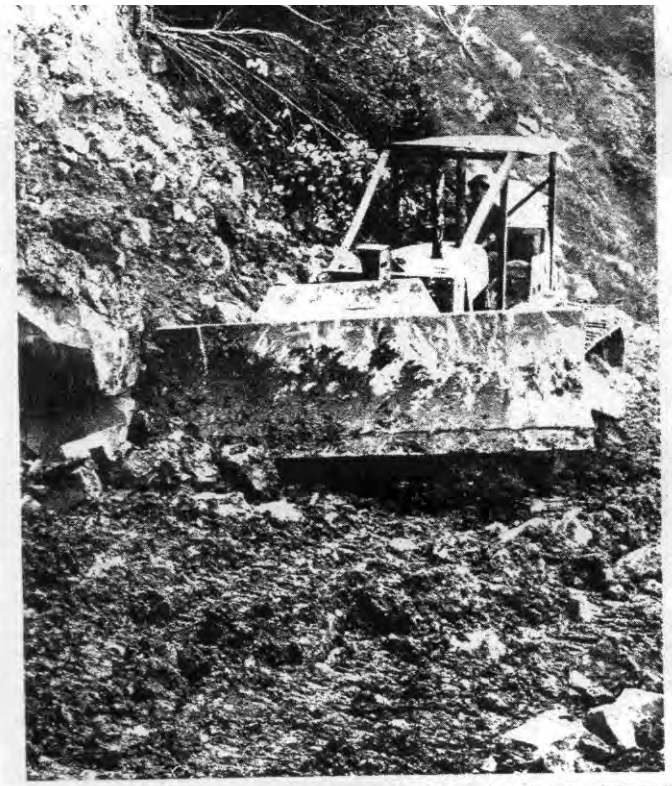
He said the formation of the sea-wall and the limestone rock going into it were the same as in other breakwater works built earlier on the Cobden seaboard. The board had used the same style of protective rock structure at the Hokitika rivermouth.

Mr Clarke said: "People ask me if the new sea-wall would ensure no recurrence of the sea's recent breaks-through. We can never guarantee anything. But it will take some shifting."

Earlier in the week, the board's chairman, Mr F. W. Wyatt, of Harihari, accompanied by Mr Clarke, inspected the work.

My Wyatt, pictured below the new wall, afterwards told the Evening Star: "If the sea can shift those rocks, we'll certainly have a sticky problem."

1969-1970

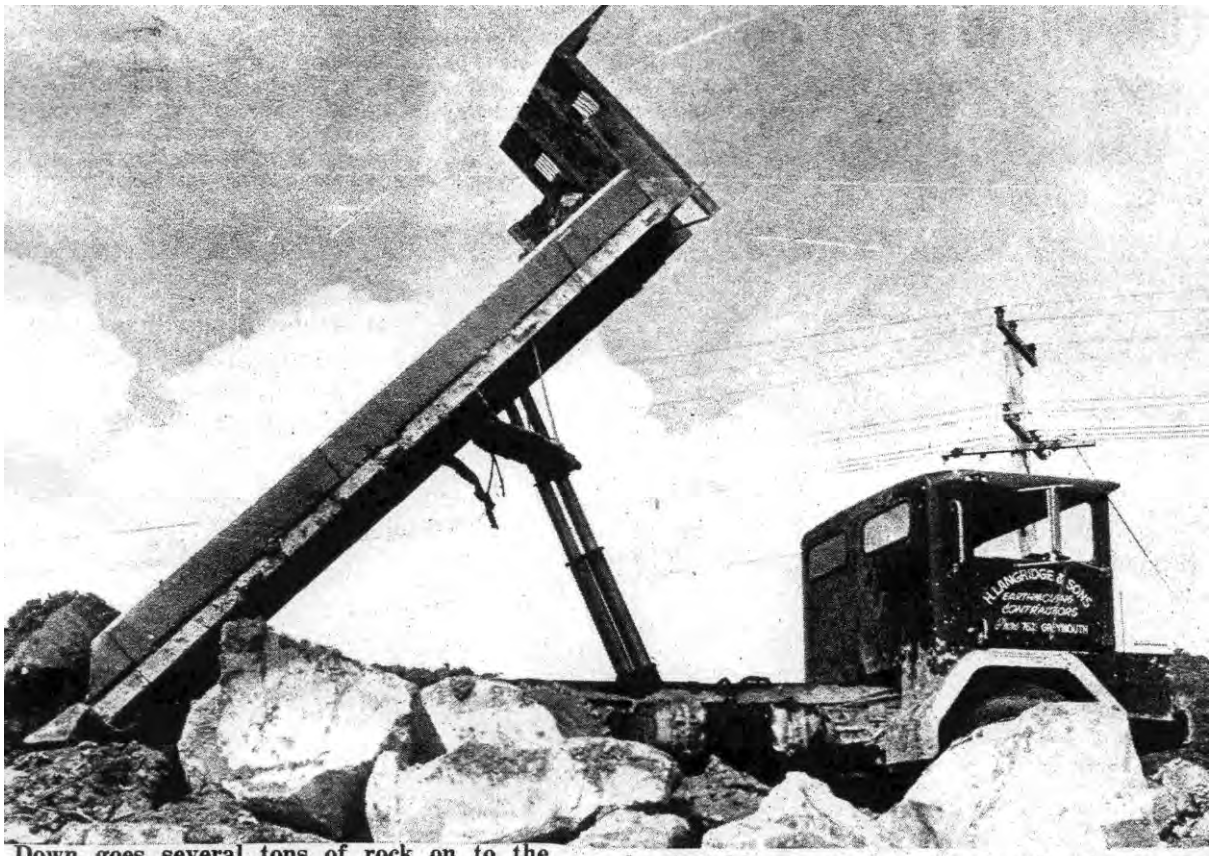


Seafront Protection for Domett Esplanade, Cobden.

Many thousands of yards of rock ha been placed along the seafront to preve the tidal waters coming over on Domett Esplanade, Cobden. The We land Catchment Board's Otira Riv Protection Work was suspended becau of the urgency accorded to the Cobd work.

Left: Bob Langridge working at a hug rock with a large bulldozer. Below: heavy boulder, some 5 feet in diamet is eased on to a truck.

1969-1970



Down goes several tons of rock on to the work, stretching away down the beach, with Domet de protection works. Below: Some idea of the Esplanade on the right. the undertaking is given by this shot of the

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DETOUR

15 August 1975

Rock To Repair Breach In Sea Wall

Rock was rushed to the scene of a breach in the sea wall at Dommett Esplanade after seas crashed through late last week. None of the houses along the esplanade were threatened by the seas although 18 inches of water covered the road and some of the sections. Rock was carted to the area on Friday, Saturday and Monday and about a third of it placed in the wall.

The contractors had another urgent job and because the receding seas meant less danger he was able to carry on with that job.

However he will be back to work soon in placing the rest of the rock.

This photo, by Frank Simpson, shows a truck dumping rock on the site.

) IN CRASHED ...AST RIVER

was used to check the rugged valleys in the area.

Late in the afternoon, a sighting was made of what was believed to be a Holden utility and a trailer, similar to those belonging to Mr Murrell. They were in the Haast River, about 150ft below the road.

The helicopter returned to the area at first light yesterday and confirmed the sighting of the vehicles. At that stage, it was not known whether or not Mr Murrell

● TORN CORPSES, SEVERED LIMBS-

PROTESTANT BAR BOMBI

FEARS OF REVENGE

BELFAST, Aug. 14 (N.Z.P.A.-Reuter). — The bombing of a Protestant bar—in which four people were killed and 44 injured last night—roused fears today of a swift revenge attack.

The bombing turned the Bayardo Bar, on Belfast's Shankill Road, into a tangle of smoking debris, torn corpses and limbs severed from screaming survivors.

It was one of the bloodiest incidents of the year in Northern Ireland. The Irish Republican Army has been ostensibly observing a ceasefire.

Coming right in the heart of a Protestant stronghold district, it brought angry crowds out on the streets, calling for revenge.

BL

Asset Management & Engineering Division
Grey District Council

P.O. Box 382, 105 Tainui Street, Greymouth
Telephone (03) 768 1700 Fax (03) 768 1703

26 May 1998 A15/3 Phone : (03) 768 1711 Fax : (03) 768 1710

Attn: Miles Rowe
West Coast Regional Council
P O Box 86
GREYMOUTH

Dear Sir

COBDEN BEACH LAND USE CONSENT

Enclosed is an application for land use consent for the work which was done along Domett Esplanade. We have applied for a consent period of 35 years so we can fix any low spots where the high seas break through and effect our road in the future.

Yours faithfully

DAVID EVANS
TRANSPORT ENGINEER

encl

Administration & Finance
Ground Floor
Fax: (03) 768 1703

Engineering & Regulations
First Floor
Fax: (03) 768 1710

Runanga Service Centre,
25 Carroll St. Runanga.
Phone: (03) 762 7813

Library,
Albert Mall, Greymouth.
Phone/Fax: (03) 768 5597

Swimming Baths,
Turumaha St. Greymouth.
Phone: (03) 768 9076

History House
25 Gresson St. Greymouth
Phone: (03) 768 4028

THE WEST COAST
REGIONAL COUNCIL

153 Tainui Street
P.O. Box 66, Greymouth
The West Coast, New Zealand
Telephone (03) 768 0466
Toll Free 0800 800118
Facsimile (03) 768 7133

Consent No. 108/98 (for office use only)

1

Resource Consent Application

Applicant(s) name(s): (Please write all names in full)

GREY DISTRICT COUNCIL

Postal Address: P.O. Box 382
GREYMOUTH

Telephone: Business: 768 1700
Private:
Facsimile: 768 1710

Property owner's name: (If different from above)

Telephone: Business:
Private:
Facsimile:

Service name and address: (If different from above)

Telephone: Business:
Private:
Facsimile:

Location of activity and/or property address:

Map Reference NZMS 260: J31
(1:50,000) 620 620 – 631 663

(include the name of any relevant stream, river or other water body to which the application may relate, proximity to any well known landmark, etc.)

Legal description: Legal Road Reserve Domett Esplanade and North Beach Rocks Section Part of Greymouth Harbourboard land owned by Grey District Council Pt RES 1428
(from rates notice, CT or valuation notice).

Territorial authority in which land is situated: (Place a ✓ in the appropriate ☐)

- Westland District Council ☐
- Grey District Council ☑
- Buller District Council ☐

Consent(s) being applied for (The appropriate form must be attached for each box ticked)

Water:

Dam ☐ Divert ☐ Take Surface Water ☐ Take Groundwater ☐

Discharge onto or into:

Land ☑ Water ☐ Air ☐

Land Use:

Bore Construction ☐ or alteration ☐

Activities in or on beds of lakes or rivers ☐ Land clearing/tracking/logging ☐

Coastal:

Activities in or on the coastal marine area (ie. below mean high-spring tide)? ☐

Term 35 (years)

Do you require any other resource consents from the territorial authority? Yes ☐ No ☑

If Yes, please list:

.....

.....

Have these consents been applied for? Yes ☐ No ☐

Consultation

Have you discussed your proposal with your neighbours and other parties who may be affected (eg. Fish and Game Council, Department of Conservation, Iwi, Transit New Zealand, user groups and interest groups)

Yes ☐
No ☑

If so, who was consulted? .....

.....

.....

Do they have any concerns? .....

.....

.....

If so, how can these concerns be met? .....

.....

.....

What are the names of the adjoining landowners neighbours and affected parties?

(1) Owner's name: Grey District Council owner of all the
Address: the land concerned.
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(2) Owner's name:
Address:
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(3) Owner's name:
Address:
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(4) Owner's name:
Address:
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(5) Owner's name:
Address:
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(6) Owner's name:
Address:
Telephone/Facsimile:

Occupier's Name:
Address:
Telephone/Facsimile:

(Continue on a separate page if necessary)

Sketch of the locality and activity points and/or supply an aerial photograph with activity points marked on it:

See attached.

Have you remembered to?

	Yes	Check
• Sketch the locality and activity points or supply an aerial photograph?	☑	☐
• Pay the application fees? (Please invoice account)	☐	☐
• Include permit application forms for each box ticked above?	☑	☐
• Complete an assessment of effects?	☑	☐
• Include a plan of any structures for which an application is being made?	☑	☐

I hereby certify that, to the best of my knowledge and belief, the information given in this application is true and correct. I undertake to pay all actual and reasonable application costs incurred by the Regional Council.

Signature of applicant: ..... Date: 22/5/98.

Name: (Block Capitals) DAVID MICHAEL EVANS.

Fees

A deposit fee must accompany your application

Type of Permit	Fee Low Impact	Fee Higher Impact
Land Use Consent	$112.50	$225.00
Coastal Permit	$112.50	$225.00
Water Permit	$112.50	$225.00
Discharge Permit	$112.50	$225.00

All Fees are G.S.T. Inclusive

Fees are a deposit. If actual costs of proceedings, including background investigations etc., exceed deposit then applicant will be liable for additional actual costs. When processing costs are less than the application fees, a refund of the credit balance will be made.

THE WEST COAST
REGIONAL COUNCIL

153 Tainui Street
P.O. Box 66, Greymouth.
The West Coast, New Zealand.
Telephone (03) 768 0466
Toll Free 0800 800118
Facsimile (03) 768 7133

Consent No ..... (for office use only)

11

Land Use Consent Application
For Tracking/Logging/Land Clearing/ Land Disturbance

Please answer all questions fully. You should discuss your application with Council officers before completing this form.

Show the location of the activity and the adjoining properties on your map on Form 1. Include design plans and details with this application.

Part A: General

1. Please indicate the type of work to be carried out:

   Tracking ☐ Logging ☐ Land Clearing ☐ Land Disturbance ☑

   What do you propose to do and why?

   Dump and level gravel + soil some vegetation into low spots on the Domett Esplanade / North Beach Road sea wall embankment. Two to the west side of the above roads the proposed work is designed to plug gaps / low points where in times of high seas - waves break through pushing driftwood etc onto the road partially closing the road.

2. What is the area involved? 5 ha. hectares

3. Is any native vegetation to be removed? Yes ☑ No ☐

   If Yes, is the height:

   Up to 2 metres? ☑ 2 metres to 10 metres? ☐ 10 metres plus? ☐

4. Is there a watercourse, dry or flowing, passing through the operation? Yes ☐ No ☑

   If Yes, please name: .....

5. Are there any permanent or temporary river crossings proposed? Yes ☐ No ☑

   If Yes, how many locations? .....

6. What is the proposed commencement date of the work? May 1998 - 35 yrs

7. What is the proposed completion date? .....

Part A: General (Continued)

8. Describe how the work will be carried out:
Grey District Council will assign areas to be filled by local contractors only gravel, spoil, soil and rock to be used when clearing for roadworks etc in Cobden area - site to be identified fill material dumped and site levelled as fitted.

9. Who will be undertaking the work? Various Contractors contracted to GDC

10. What are the proposed hours of operation/construction? 7am - 6pm occasional days only.

Part B: Assessment of Effects on the Environment

Where your activity could have a significant adverse effect on the environment a more detailed environmental assessment is required in accordance with the Fourth Schedule of the Resource Management Act 1991. A consents officer can discuss this with you.

1. Are there any alternative locations or methods for carrying out the work. Yes ☐ No ☐

(1) If Yes, where or how?

(2) Why have you chosen this location or method over the others?
It is a useful way of disposing of fill material because you are actually helping to strengthen the sea/wave wall protection for the road.

2. Within a reasonable distance of the activity are there any:

		Yes	No
(1)	Obvious signs of biota (eg. fish, eels, insect life, aquatic plants)?	☐	☑
(2)	Areas where food is gathered (eg. watercress, fish, kaimoana)?	☐	☑
(3)	Wetlands (eg. swamp areas)?	☐	☑
(4)	Recreational activities carried out (eg. swimming, fishing, canoeing)?	☑	☐
(5)	Areas of particular aesthetic or scientific value (eg. archaeological sites, scenic waterfalls, rapids)?	☐	☑
(6)	Will any land instability result from the removal of vegetation?	☐	☑
(7)	Will any water be channelled as a result of soil disturbance?	☐	☑
(8)	Will hazardous or toxic chemicals be used or stored on site (eg., fuel)?	☐	☑
(9)	Will the water quality be affected?	☐	☑
(10)	Will access to the lake or river be affected?	☐	☑

Describe the plants, animals and habitat of the surrounding area:
Lupin, lake lake, gorse

(Continue on a separate page if necessary)

Part B: Assessment of Effects on the Environment (continued)

If you have answered Yes to any of the above, describe what effects your proposed land use consent may have and the steps you propose to take to mitigate these:

Some suting carried out along beach areas - work will be carried out on road reserve well away from any suting places - Public access to the beach will not be hindered.

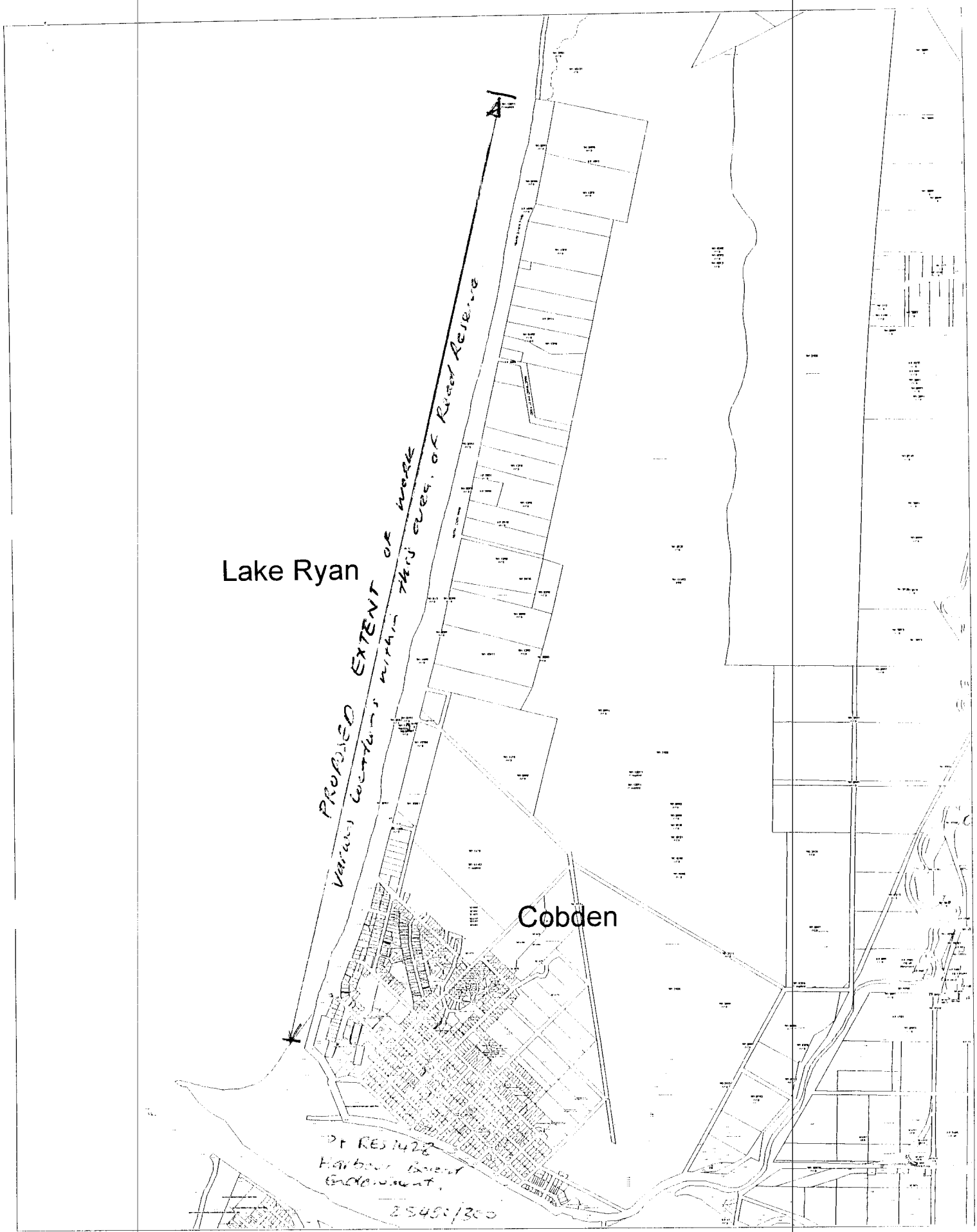
We are usually applying to fix an existing sea wall on our own property when required to do so using the most economical methods.

(Continue on a separate page if necessary)

3. Do you propose to undertake any type of monitoring? Yes ☑ No ☐

If Yes, what?

Grey District Council Engineering Staff will monitor the work - We will notify contractor where to place fill and how to tidy up.



Scale 1:25000

0 250 500 750 1000 1250 1500 1750 2000 2250 2500 2750 3000m

COBDEN BEACHFRONT

TERRALINK NZ LTD(Terraview)-DCDB Data as at 27.08.97Title & VNZ data as at 5.08.97.

THE WEST COAST
REGIONAL COUNCIL

153 Tainui Street,
P.O. Box 66, Greymouth.
The West Coast, New Zealand.
Telephone (03) 768 0466
Toll Free 0508 800 118
Facsimile (03) 768 7133

Enquiries to: Nathan Hole
Our ref: RCN98/193

26 November 2001

Grey District Council
P.O. Box 382
Greymouth

Dear Sir/Madam

RESOURCE CONSENT RCN98193

Further to earlier correspondence please find enclosed your Resource Consent.

Yours faithfully,

Nathan Hole
Regulations and Consents Officer
For:
Toni Morrison
Planning and Consents Manager

THE WEST COAST
REGIONAL COUNCIL

153 Tainui Street,
P.O. Box 66, Greymouth.
The West Coast, New Zealand.
Telephone (03) 768 0466
Toll Free 0508 800 118
Facsimile (03) 768 7133

RESOURCE CONSENT

Pursuant to Part VI of the Resource Management Act 1991 The West Coast Regional Council hereby grants to:

GREY DISTRICT COUNCIL
P.O. BOX 382
GREYMOUTH

A Resource Consent for the term and upon the conditions hereinafter set forth:

File No.:	RCN98193
Resource Consent No.:	RC98193/1
Date Of Issue:	26 November 2001
Term:	35 years
Type of Resource Consent:	Land Use Consent
Purpose of Resource Consent:	For earthworks associated with maintaining a seawall at Cobden
Location:	Domett Esplanade and North Beach Roads, Cobden
Legal Description:	Legal Road Reserve Domett Esplanade and North Beach Road, Cobden Pt Res 1428 Harbour Board Endowment 25480/300
Map Reference:	NZMS 260 J31: 619-617 to 631-666

Conditions:

Pursuant to Section 108 of the Resource Management Act 1991 the Resource consent includes the following conditions:

1 Works shall be carried out in accordance with the details contained in the consent application submitted to the Consent Authority, except where inconsistent with these conditions. Any change or cancellation of consent conditions shall be done in accordance with section 127 of the Resource Management Act 1991.

2 The sea wall may be maintained within the area marked on the map attached to this consent.

3 The Consent Holder shall only use clean fill material to maintain the sea wall. For these purposes clean fill is defined as sand, soil, vegetative matter, gravel and rock.

4 All clean fill material deposited shall be contained to prevent the movement of the material so that it does not result in:

a) The diversion or blockage of any waterbody; or
b) Erosion

5 Pursuant to section 128 of the Resource Management Act 1991, the Consent Authority may review the conditions of the consent annually from the date of issue of the consent, for any of the following purposes.

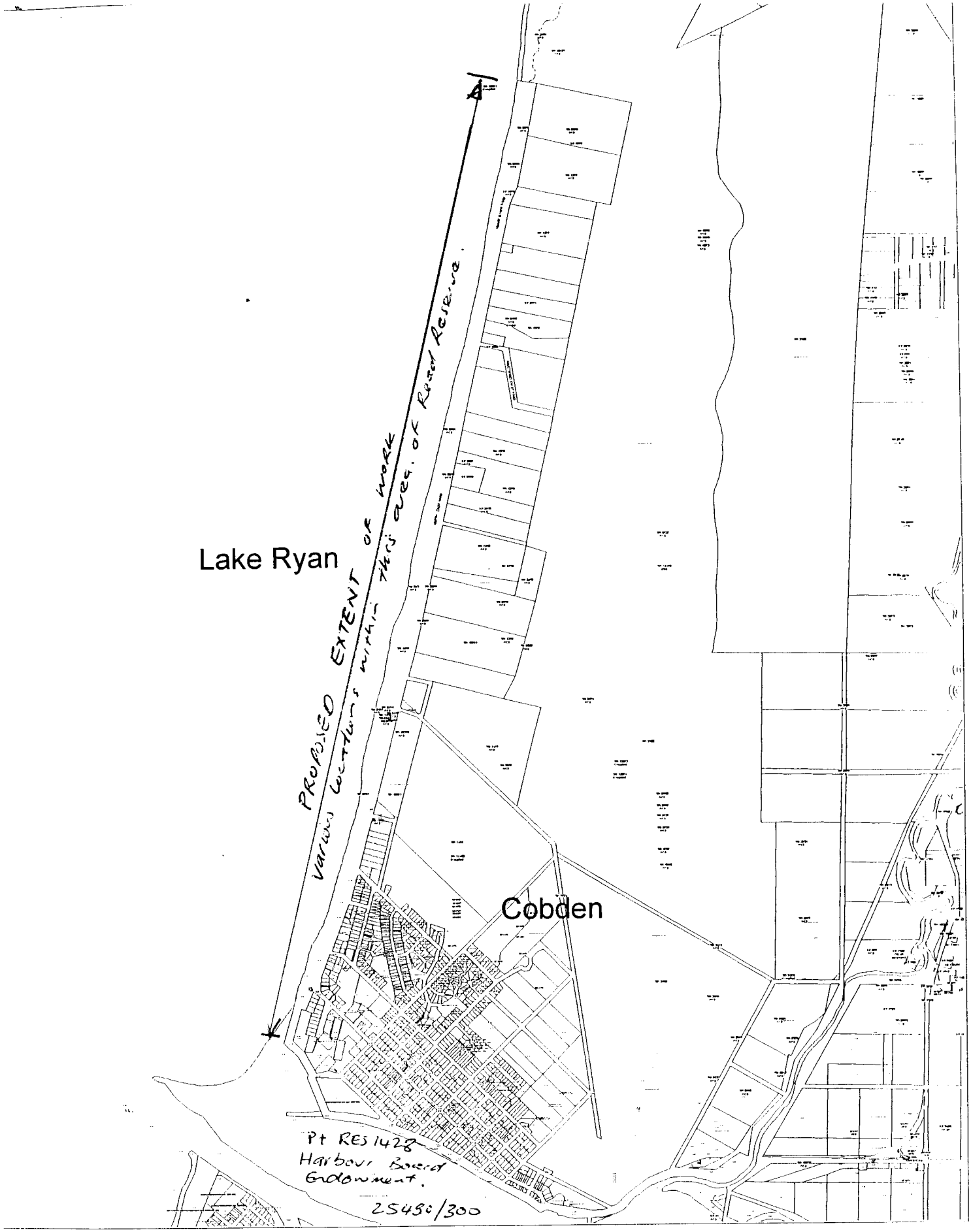
a) To deal with any adverse effect on the environment which may arise from the exercise of this consent, and which it is appropriate to deal with at a later stage.

b) To require the Consent Holder to adopt the best practicable option to remove or reduce any adverse effect on the environment.

c) If the information made available to the Consent Authority by the applicant for the consent, for the purposes of the application, contained inaccuracies which materially influenced the decision made on the application, and the effects of the exercise of the consent are such that it is necessary to apply more appropriate conditions.

6 The Consent Holder shall pay to the Consent Authority such annual administration, supervision and monitoring fees as are fixed from time to time by the Consent Authority in accordance with Section 36 of the Resource Management Act 1991.

RESOURCE MANAGEMENT OFFICERS COMMITTEE



Scale 1:25000

0 250 500 750 1000 1250 1500 1750 2000 2250 2500 2750 3000m

COBDEN BEACHFRONT

TERRALINK NZ LTD(Terraview)-DCDB Data as at 27.08.97Title & VNZ data as at 5.08.97.

Cobden Coastal Inundation Modelling

MARCH 2, 2020

Client: West Coast Regional Council

Report by: Matthew Gardner

Land River Sea Consulting Ltd

www.landriversea.com

COBDEN SEA WALL

COASTAL INUNDATION MODELLING

REVISION HISTORY

Author:	Matthew Gardner
Signature:	
Date:	2/03/2021
Revision:	01
Authorised by:	Paulette Birchfield
Signature:	
Organistation:	West Coast Regional Council
Date:	

Land River Sea Consulting Limited
PO Box 27121
Shirley
Christchurch 8640

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E: matthew@landriversea.com
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1. INTRODUCTION

SCOPE OF STUDY

Land River Sea Consulting has been contracted by the West Coast Regional Council to build a basic coastal inundation model of the Cobden coastal stretch to identify the risk to Jellyman Park as well as the surrounding residential area, should the coastal defences be overtopped or breached during a storm event.

BACKGROUND

Cobden is a low-lying suburb which has been constructed on the historic riverbed of the Grey River. Due to its low-lying nature and vicinity to both the Grey River as well as the coast it is very vulnerable to flooding from a range of sources. The sea wall has been significantly strengthened in recent years as well as raised, however the stretch of coast is currently experiencing significant pressure with the waves overtopping the existing wall as well as eroding the existing rock protection lining the sea wall.

Drone imagery captured in January 2021 very clearly illustrates the significant erosion which has occurred along the coastline with a comparison between the 2017 imagery showing coastal erosion of greater than 25m in some locations. As a result of the erosion, it is apparent that some of the natural protection from the high dune systems has been destroyed by the sea and the exposure to coastal flooding has significantly increased in recent years. Figure 1-1 and Figure 1-2 present aerial images of the same stretch of coastline and highlight the significant loss of coastal protection in front of Cobden since 2017.

It is worth noting that coastlines naturally prograde and retreat overtime, and I have not carried out an analysis into the historic coastline behaviour in this location to see if the current behaviour of coastal erosion is typical for this location.

Figure 1-1 – Drone Imagery of Coastline January 20, 2021

Figure 1-2 – WCRC imagery captured in 2017 with location of 2021 coastline highlighted in red

Visualisation of the LiDAR data very clearly highlights the low-lying nature of much of the suburban area with the area which was old riverbed clearly distinguishable based on the existing contours.

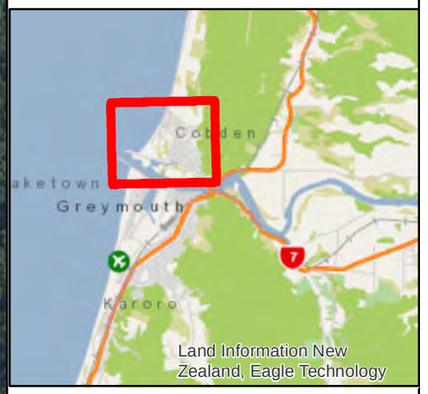
Figure 1-3 on the following page presents a coloured contour map of the modelled area allowing the low-lying nature of the area to be visualised. We have also produced three separate figures which highlight terrain below the 2m, 3m, 4m and 5m contour to further illustrate the land which will be at risk from varying sea level conditions should the coastal defences be breached. These have been presented in Appendix A for reference.

Legend

1 m Contour

Elevation – NZVD2016 (m)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- 5 >
- > 5



LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.125 0.25 0.5
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
Figure 1-3 - Coloured Contour Map of Cobden

REVISION	DATE
01	**23 February 2021**
A3 SCALE	AUTHOR
1:10,000	**Matthew Gardner**

N

AVAILABLE DATA

The following data sources have been utilised in the study:

- 2015 LiDAR data supplied by Grey District Council (AAM Hatch, 2015)
- December 2020 drone survey of coastal rock wall (Graeme Wylde, 2020)
- Sea levels taken from LINZ Nautical Almanac based on the 2020-2021 epoch (LINZ, 2021) as well as advised by Dr Michael Allis at NIWA.
- Sea level rise scenarios based on latest Ministry for the Environment (MfE) guidance (MfE, 2020)

As each data source is in terms of a different vertical datum, each data source has been converted into the New Zealand Vertical Datum 2016 for consistency.

SUMMARY OF RESULTS

Current Climate

Model results show that Cobden is vulnerable to significant inundation in a 1% Annual Exceedance Probability (AEP) stormtide event (often referred to as a 1 in 100-year event). The model shows that a section of the coast north of the existing sea wall is likely to overtop sending water into the residential settlement. These scenarios assume that the existing unlined section of gravel bund will not breach, however in reality there would be a very high probability of breach, significantly increasing the risk of inundation.

A number of simulations have therefore also been carried out with this section of unlined bund removed. Model results show as expected that flood extent and depth will increase with an increased number of properties inundated for a 1% AEP event.

Future Climate

Three separate sea level rise scenarios have been simulated in the model: 0.7m, 1m and 1.4m. Results show that with sea level rise of 0.7m sea levels, Cobden will experience a very similar level of flooding in a 10%AEP stormtide (often referred to as a 1 in 10-year event) to what is expected for a 1%AEP event with current sea levels. Results for a 1%AEP event with 0.7m sea level rise shows a large portion of the suburb to be under water (NB. Flooding is contained to those properties which are built on the historic river terrace).

2. SITE VISIT

A site visit was carried out on the 25th of January 2021 to observe the conditions on site. Significant erosion of the existing bank was visible and it was evident due to the presence of drift wood and debris on top of the bank that waves had been breaking over the top of the existing sea wall under regular conditions.

The following photos highlight conditions on site.

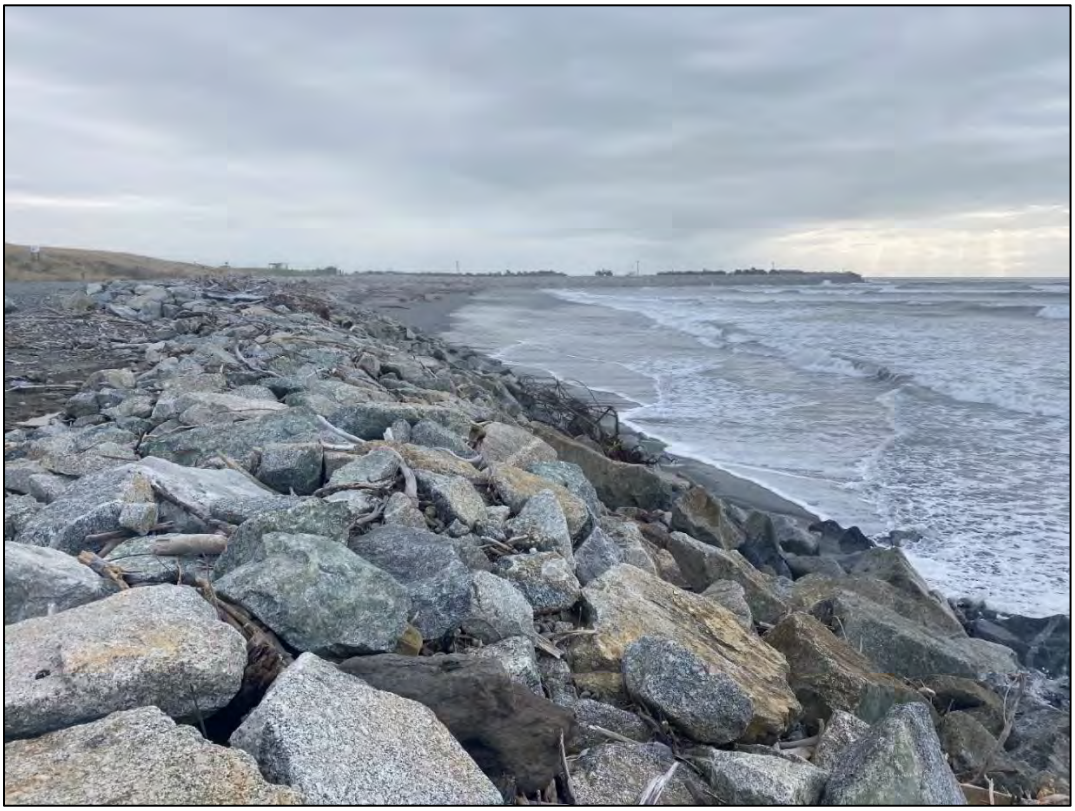


Figure 2-1 – Southern most section of wall in good condition (close to Cobden cut)

Figure 2-2 – Mid section of wall, collapsing and in serious need of repair (adjacent to Jellyman park)

Figure 2-3 – Severe erosion of the wall

Figure 2-4 – Severe erosion of wall, with rock protection falling away from the wall completely

Figure 2-5 – Northern most section of the wall with no current rock protection

The photos show that the southernmost section of the wall in front of Jellyman park is well formed and in good condition, however moving northwards, the wall deteriorates in condition significantly with the northern most section of wall being nothing more than a gravel bund that would collapse immediately were it put under any pressure from the sea.

Figure 2-6 – Gravel bund easily erodible by the sea during a storm event

3. MODEL BUILD

A model of the coastal stretch has been developed using MIKE21 FM software. The model setup consists of a mesh which represents the ground terrain as well as a coastal boundary. The model is simplistic in that it is not accurately modelling the wave dynamics, it is simply modelling a dynamic peak water level that rises and falls with the tide. As a result, the flood inundation maps are likely to be conservative and may show more inundation than is likely to occur during a real event, however the maps do show maximum potential flood extent for these tide scenarios.

MESH SETUP

The mesh has been set up with a variable resolution with a maximum mesh resolution of 50m^2 for the coastal area and 15m^2 for the land area. The model has been extended for a distance of approximately 4km to the north of the Grey River mouth with the full modelled extent and summary of mesh resolution presented in Figure 3-1.

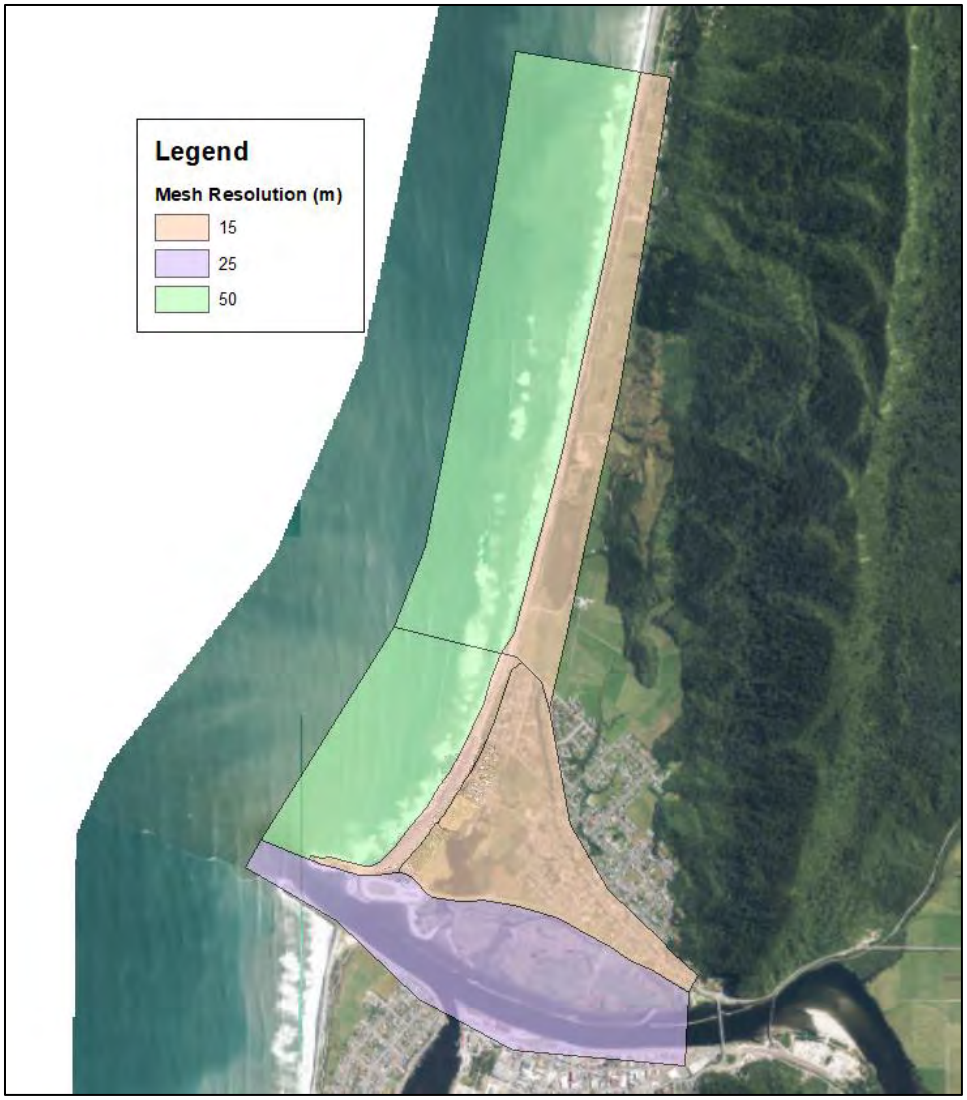


Figure 3-1 – Model Extent

The topography has been interpolated based on the 2015 LiDAR as well as the 2020 drone survey. Due to the fact that vegetation was not removed from the 2020 drone survey, I have clipped the drone survey to the area shown in Figure 3-2 below. The rest of the model is based on the 2015 LiDAR.

Figure 3-2 – Drone Survey Clip Extent

A comparison of the drone survey data with the 2015 LiDAR on open hard surfaces has shown that it ties in well, allowing for a simple merge of the two datasets.

TIDE BOUNDARY

The tidal levels have been based on the reported tide levels provided by Land Information New Zealand (LINZ) in their New Zealand Nautical Almanac. All levels reported by LINZ are in terms of Chart Datum (CD) and are relative to the levels at Westport.

In order to convert chart datum levels to NZVD2016, the following conversion has been used:

Chart Datum is 7.351m below B.M. Harbourmasters Office (LINZ code DJMC). A search of the LINZ database reports the following info for this mark (as at 12/1/2021).

NZVD2016	**5.22**
LVD1937	**5.5724**

Chart Datum in NZVD2016 therefore is equal to: 5.22 – 7.35

= -2.13 m

Mean Spring, Neap and Sea Level Heights (m)

Vertical Datum	**No.**	**Port**	**MHWS**	**MHWN**	**MLWN**	**MLWS**	**MSL**
Chart Datum	6524	Greymouth	3.3	2.6	1.1	0.6	1.9
NZVD2016	6524	Greymouth	1.17	0.47	-1.03	-1.53	-0.23

We have adopted a Mean High Water Spring 7 (MHWS7) definition in order to be consistent with NIWA coastal modelling carried out for the NZ Government. MHWS7 is the mean high water spring tide exceeded 7 percent of the time and is a practical fixed level to use for infrastructure design.

STORM SURGE / WAVE SETUP

Suitable values for the storm surge and wave setup components for Greymouth have been provided by Dr Michael Allis from NIWA which has been taken from current research as part of the Deep South challenge and are summarised in Table 3-1 below. Wave runup has not been accounted for in this model.

Table 3-1 – Summary of individual components making up tide level

	10%AEP Stormtide	**1%AEP Stormtide**
Storm Surge	0.43	0.59
Wave Setup	1.97	2.48
Monthly Sea Level Variation	0.14	0.14
Peak Water Level (NZVD2016)	**3.77**	**4.44**

Figure 3-3 illustrates the various components which make up the final water level used in this model.

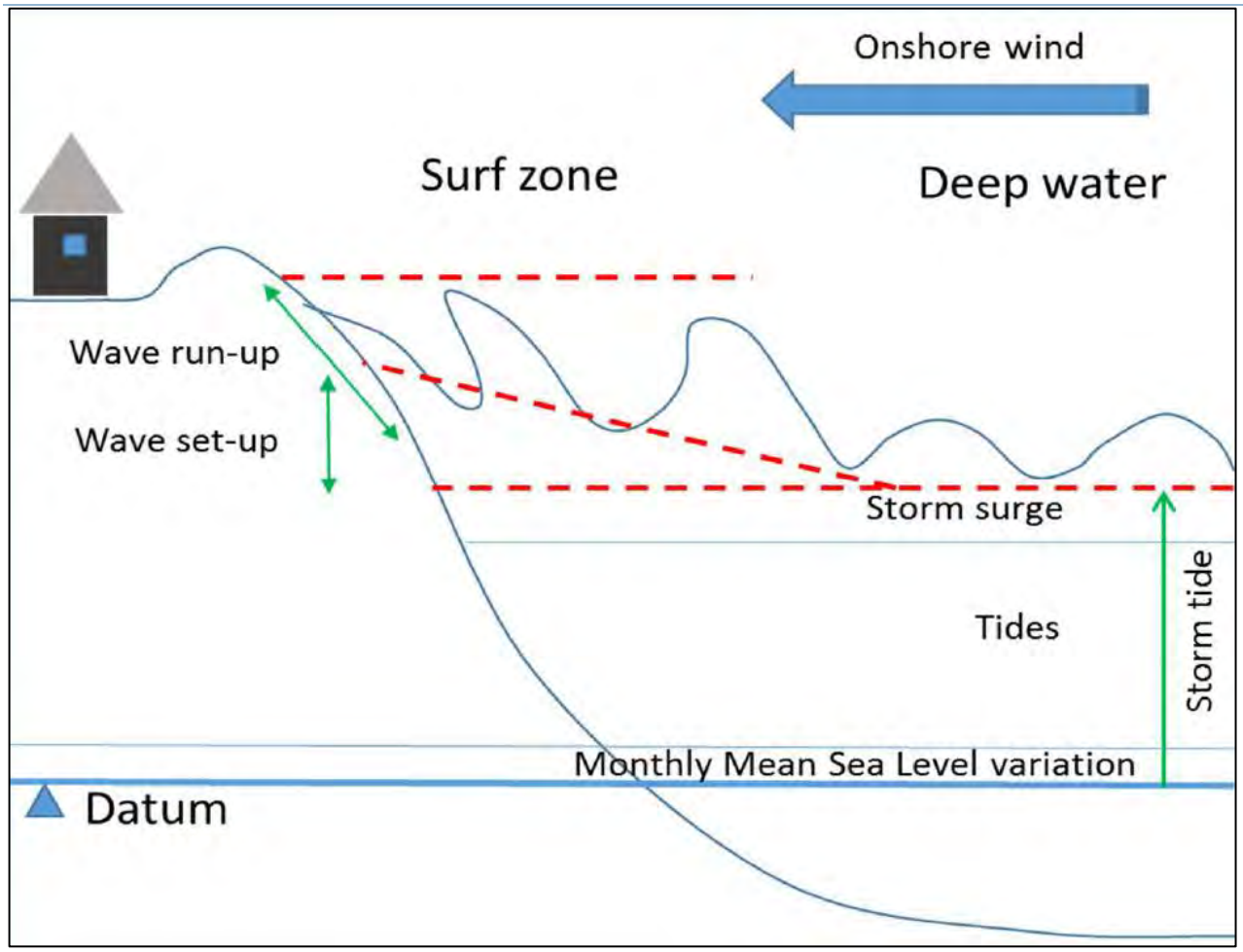


Figure 3-3 – Illustration of components leading to storm-driven inundation at the coast. MSLA = MSL Anomaly (Bell, et al., 2015)

BREACH SCENARIO

A breach scenario has been simulated, which has allowed for the unlined northern most section of the sea wall to be breached. The breach has been simulated by simply removing the unlined portion of the wall from the terrain and lowering it to a level of 4m (NZVD2016).

The location of the simulated breach is presented in Figure 3-4 below.

Figure 3-4 – Location of simulated breach (yellow line)

SEA LEVEL RISE

Sea level rise scenarios have been based on the latest MfE guidance (MfE, 2017).

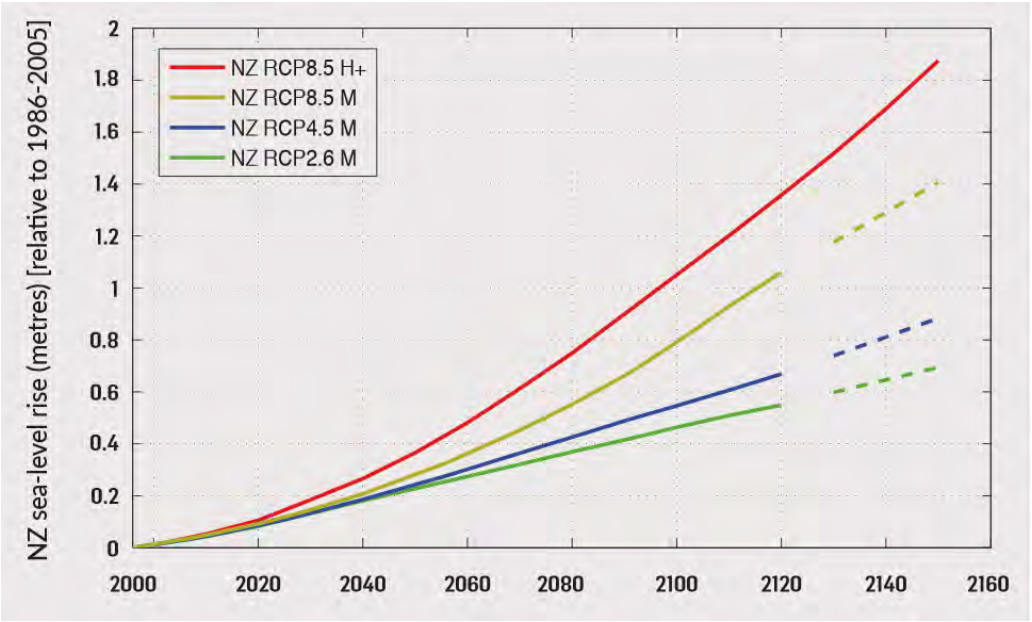


Figure 3-5 – NZ sea-level rise projection scenarios to 2050 (MfE, 2017)

We have selected three sea level scenarios to simulate based on the Resident Concentration Pathways (RCP) assuming a timeframe of approximately 100 years (ie to 2120). These RCP values represent different

concentrations of CO_2 in the atmosphere. We have therefore selected 0.7m, 1m and 1.4m representing the RCP4.5, 8.5 and 8.5H+ scenarios. Please note that the RCP8.5H+ is considered to be an extreme case scenario should there be no future reduction of greenhouse gas emissions.

4. MODEL SIMULATIONS

The following tide scenarios have been simulated in the model.

Scenario Number	Tide Scenario	Climate Scenario	Peak Sea Level NZVD2016 (m)
1	10% Stormtide	Current Climate	3.77
2	1% Stormtide	Current Climate	4.44
3	10% Stormtide	0.7m SLR	4.47
4	10% Stormtide	1m SLR	4.77
5	10% Stormtide	1.4m SLR	5.17
6	1% Stormtide	0.7m SLR	5.14
7	1% Stormtide	1m SLR	5.44
8	1% Stormtide	1.4m SLR	5.84
9	10% Stormtide (breach)	Current Climate	3.77
10	1% Stormtide (breach)	Current Climate	4.44
11	10% Stormtide (breach)	0.7m SLR	4.47
12	10% Stormtide (breach)	1m SLR	4.77
13	10% Stormtide (breach)	1.4m SLR	5.17
14	1% Stormtide (breach)	0.7m SLR	5.14
15	1% Stormtide (breach)	1m SLR	5.44
16	1% Stormtide (breach)	1.4m SLR	5.84

5. MODEL RESULTS

Model results are most easily described through a visual presentation and have therefore been presented as peak depth maps which are included in Appendix A.

The following general conclusion can be drawn from the results however:

5.1 CURRENT CLIMATE

Results show that under existing sea levels and with the existing coastline still intact, we can expect that the current defences will be sufficient to prevent inundation under a a 10%AEP event, even if the unlined section of bank is breached. However if a 1%AEP stormtide occurs, then we can expect inundation of a significant number of properties. It the unlined section of bank also breaches, then the number of properties inundated will increase even further and flood depths will be greater.

5.2 FUTURE CLIMATE (2120)

The model has been used to test the sensitivity to a range of sea level rise scenarios. Results essentially show that with if sea levels are to rise by 0.7m, then the degree of flooding currently experienced in a 1%AEP event will now be experienced in a 10%AEP event. (Ie a 1 in 100 year event, will become a 1 in 10 year probability event).

If sea level rises more than 0.7m, then the degree of flooding increases significantly with large portions of low lying land at risk of inundation.

6. REFERENCES

Bell, R.G., Paulik, R. and Wadwha, S. 2015. *National and regional risk exposure in low-lying coastal areas.* Hamilton : NIWA, 2015. HAM2015-006.

MfE. 2017. *Preparing for coastal change - A summary of coastal hazards and climate change guidance for local government.* Wellington : Ministry for the Environment, 2017.

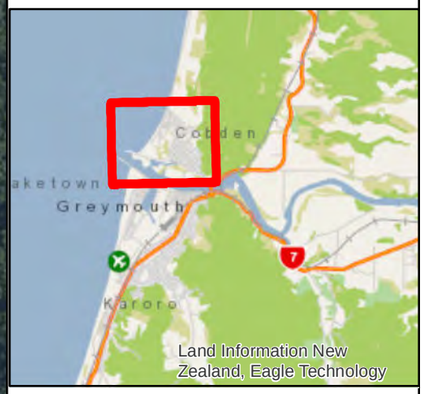
APPENDIX A – MAPS HIGHLIGHTING LAND BELOW SPECIFIC CONTOURS

Legend

Elevation – NZVD2016 (m)

2 >

> 2



LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.125 0.25 0.5
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
Land below 2m contour

REVISION	DATE
01	**23 February 2021**
A3 SCALE	AUTHOR
1:10,000	**Matthew Gardner**

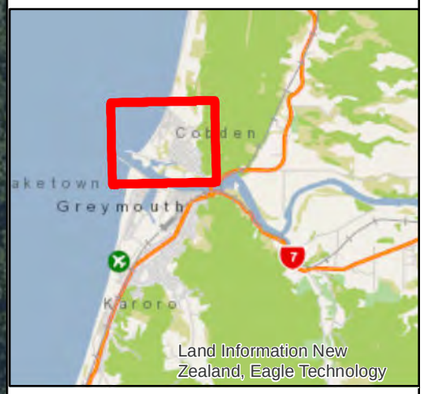
N

Legend

Elevation – NZVD2016 (m)

3 >

> 3



LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.125 0.25 0.5
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
Land below 3m contour

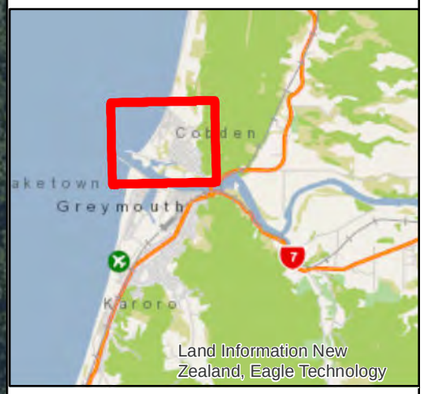
REVISION	DATE
01	**23 February 2021**
A3 SCALE	AUTHOR
1:10,000	**Matthew Gardner**

N

Legend

Elevation – NZVD2016 (m)

- 4 >
- > 4



LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.125 0.25 0.5
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
Land below 4m contour

REVISION	DATE
01	**23 February 2021**
A3 SCALE	AUTHOR
1:10,000	**Matthew Gardner**

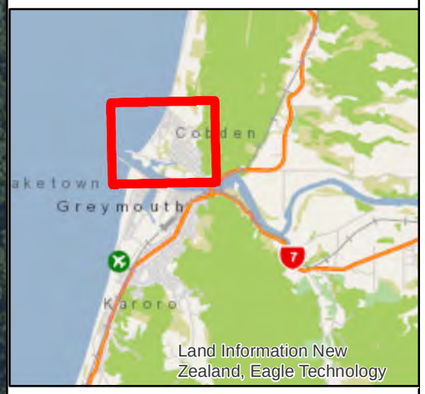
N

Legend

Elevation – NZVD2016 (m)

5 >

> 5



LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.125 0.25 0.5
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
Land below 5m contour

REVISION	DATE
01	**23 February 2021**
A3 SCALE	AUTHOR
1:10,000	**Matthew Gardner**

N

APPENDIX B – PEAK DEPTH MAPS

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide, 0.7m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide, 1m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide, 1.4m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

60

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
1% Storm Tide

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

61

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
1% Storm Tide, 0.7m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

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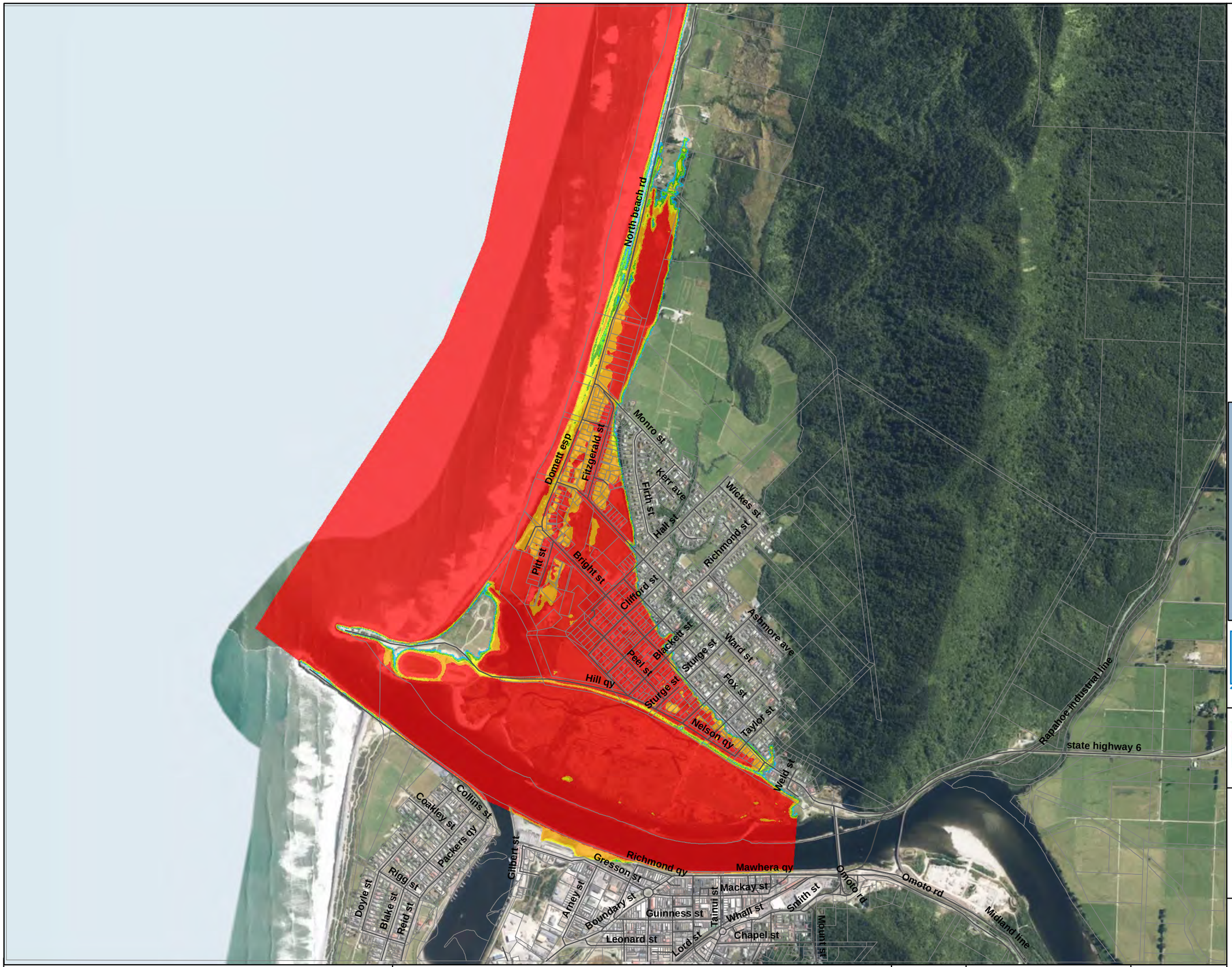

Legend

- Roads
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Peak Depth (m)

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- 0.3 - 0.5
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- 1 - 2
- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

62

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
1% Storm Tide, 1m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Roads
- Land Parcel

Peak Depth (m)

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- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
1% Storm Tide, 1.4m Sea Level Rise

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Breach
- Roads
- Land Parcel

Peak Depth (m)

- 0
- 0 - 0.05
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- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide (Breach)

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Legend

- Breach
- Roads
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Peak Depth (m)

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- 2+

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

0 0.25 0.5 1
Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide , 0.7m Sea Level Rise (Breach)

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

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Legend

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Peak Depth (m)

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Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
10% Storm Tide , 1m Sea Level Rise (Breach)

REVISION	DATE
01	**25 February 2021**
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1:20,000	**Matthew Gardner**

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Legend

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PROJECT
Cobden Coastal Inundation Modelling

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REVISION	DATE
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1:20,000	**Matthew Gardner**

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Kilometers

PROJECT
Cobden Coastal Inundation Modelling

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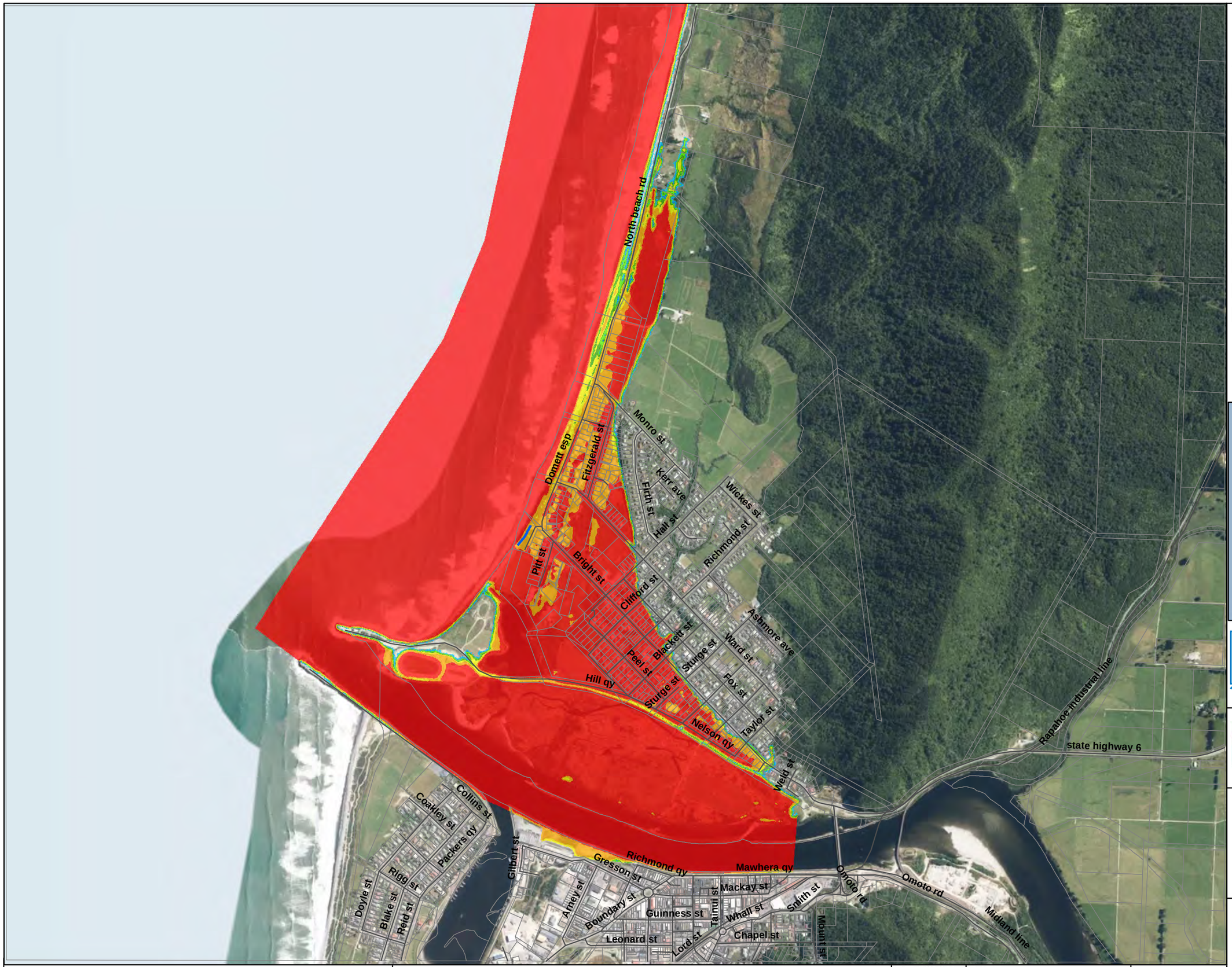

Legend

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THE WEST COAST REGIONAL COUNCIL

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Kilometers

PROJECT
Cobden Coastal Inundation Modelling

MAP TITLE
PEAK DEPTH MAP
1% Storm Tide, 1.4m Sea Level Rise (Breach)

REVISION	DATE
01	**25 February 2021**
A3 SCALE	AUTHOR
1:20,000	**Matthew Gardner**

N

Jellyman Park Seawall Options report – July 2022 update

P Birchfield, Area Engineer

Modelling undertaken in 2021 by Land River Sea Consulting Ltd shows that much of Cobden, due to its low-lying nature and vicinity to both the Grey River and the coast is vulnerable to coastal flooding. The model shows that without works to upgrade the existing coastal protection structures fronting, and north of Jellyman Park, Cobden will be subject to significant inundation in a 1% Annual Exceedance Probability (AEP) event (Figure 1). The inundation map in Figure 2 shows the increase in flooding from the mid-range of the three modelled 100-year (Year 2120) sea level rise scenarios of 0.7m. 1.0m and 1.4m.

The Land River Sea Consulting Ltd report follows recommendations from the 2020 NIWA report: *Coastal change at Cobden Beach, Greymouth* that include construction of a replacement coastal defence at Jellyman Park. This coastal defence would act as a backshore buffer set well back from the beach face to manage coastal erosion risk to the Cobden community over the short-medium (5-30 year) timeframe. The buffer space allows the beach to absorb cycles of storm erosion and rotate with changes to sediment supply, or wave refraction.

These reports highlight the vulnerability of Cobden to impacts from both coastal erosion and coastal flooding, therefore any proposed coastal defences should be constructed to protect against inundation, provide resilience to coastal erosion, and be aligned to accommodate the large fluctuations in shoreline position that occurs at Cobden Beach.

NIWA provided three alignment options for coastal defence structures (seawalls) in the 2020 report (Figure 10); Option 1 is the inland alignment that would provide the best protection as it would accommodate the largest fluctuations in shoreline position (Figure 3); Option 2 attempts to balance encroachment onto Jellyman Park but would not be as successful over the medium term with a narrow beach buffer (Figure 4); and Option 3 would ease the current erosion but would be a short-term measure remaining susceptible to storm damage and downdrift erosion effects (Figure 5).

To obtain more detailed alignments and volumes for the three options, Jellyman Park and the surrounding area was mapped (3D and 2D) via drone by Graeme Wylde Surveying Ltd and the alignment options overlaid onto aerial maps and typical cross sections plotted (maps and cross

sections shown below). Volumes for the deconstruction of the existing seawall and construction of a new seawall were obtained from both drone and ground survey methods. The alignments for the three options were obtained from the 2020 NIWA report but extend a further 30m north along Domett Esplanade to tie into substantial existing rockwork placed in the late 1960's.

As shown on the aerial maps, Options 2 and 3 allow for the continued use of one playing field at Jellyman Park if the field is reconfigured to an alternate layout, but Option 1 precludes the use of the full playing field.

The draft seawall design drawings have a crest level based on the height of the Grey District Council designed Cobden Dump seawall. This is higher than the existing coastal protection structures at Jellyman Park and will provide better protection against coastal flooding. The crest height of the proposed seawall may be subject to change depending on its required service level (i.e., 1% or 10% AEP)

Indicative costs for the three options are shown in Figure 9. These indicative costs were derived from contract rates from previous works around Cobden and Greymouth and from discussions with local contractors. Options 1 and 2 are the most expensive with a greater amount of material required due to the set-back alignment and the inclusion of beach nourishment, although the contract works for both Option 1 and Option 2 could be staged due to the proposed set-back. This could be achieved by deferring placement of the full volume of armour rock until the next stage of the works. The use of beach nourishment as an additional protection measure would allow the project works to be staggered. The remaining volume of rock to complete Options 1 and 2 would be placed only when necessary.

Option 3 has the lowest initial costs, but the project works could not be staggered. In addition, Option 3 would have the highest annual maintenance costs due to the seaward alignment, susceptibility to storm damage, and the increased risk of downdrift erosion effects.

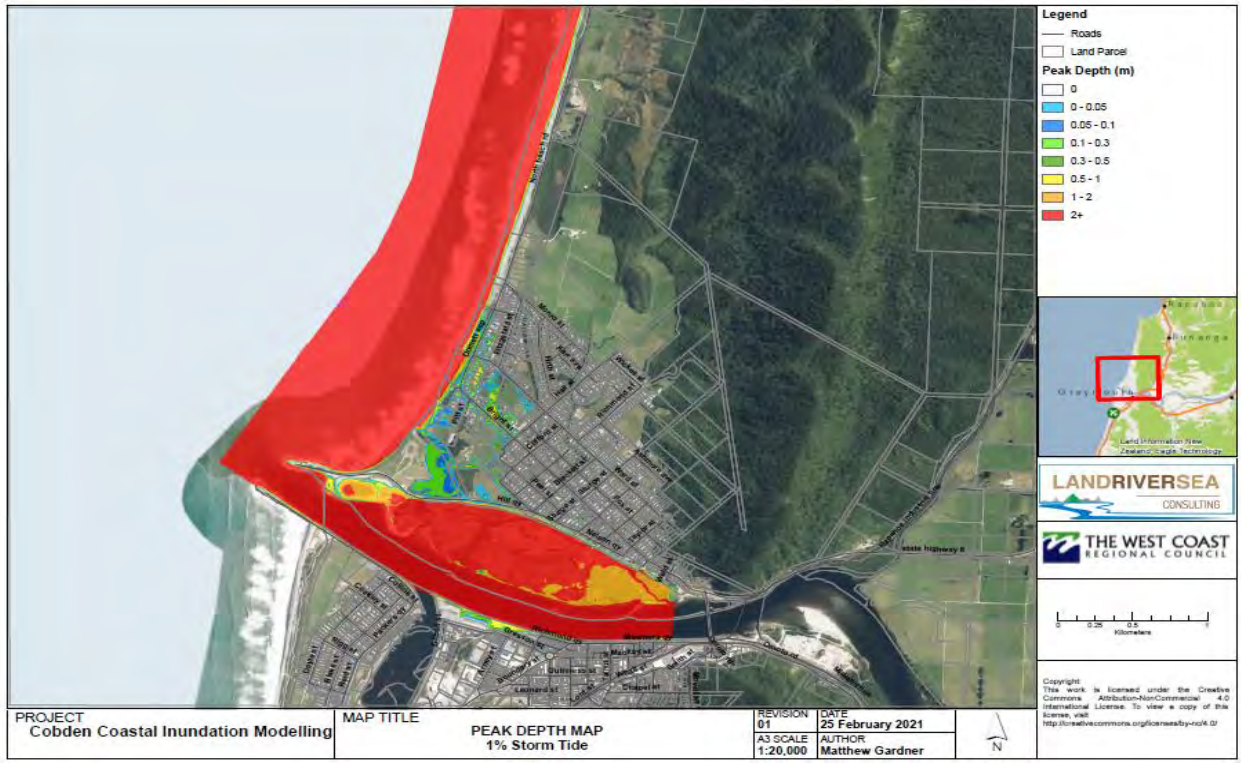

Figure 1: Modelled inundation by coastal flooding in a 1% AEP event [Credit: Cobden Coastal Inundation Modelling. Land River Sea Consulting Ltd. March 2021].

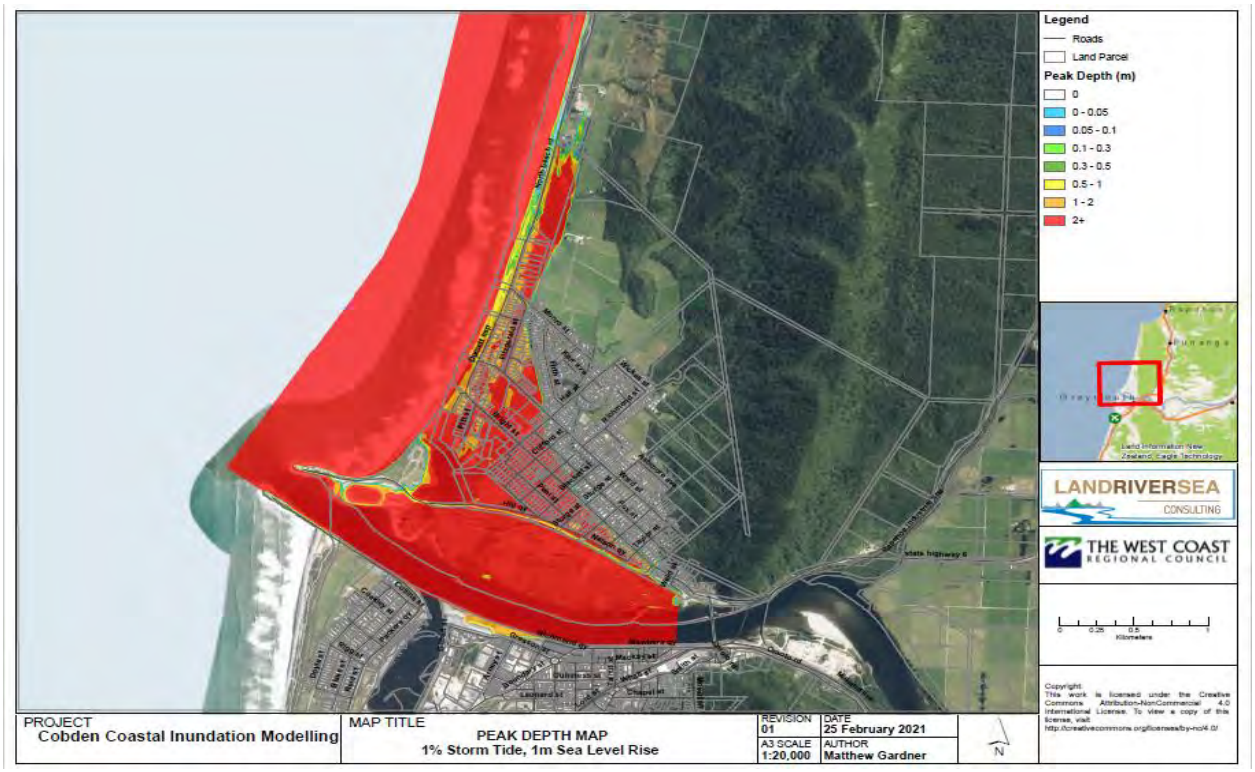

Figure 2: Modelled inundation by coastal flooding in a 1% AEP event with 1m of SLR (2120) [Credit: Cobden Coastal Inundation Modelling. Land River Sea Consulting Ltd. March 2021].

Figure 3. Aerial map showing Option 1 alignment.

Figure 4. Aerial map showing Option 2 alignment.

Figure 5. Aerial map showing Option 3 alignment.

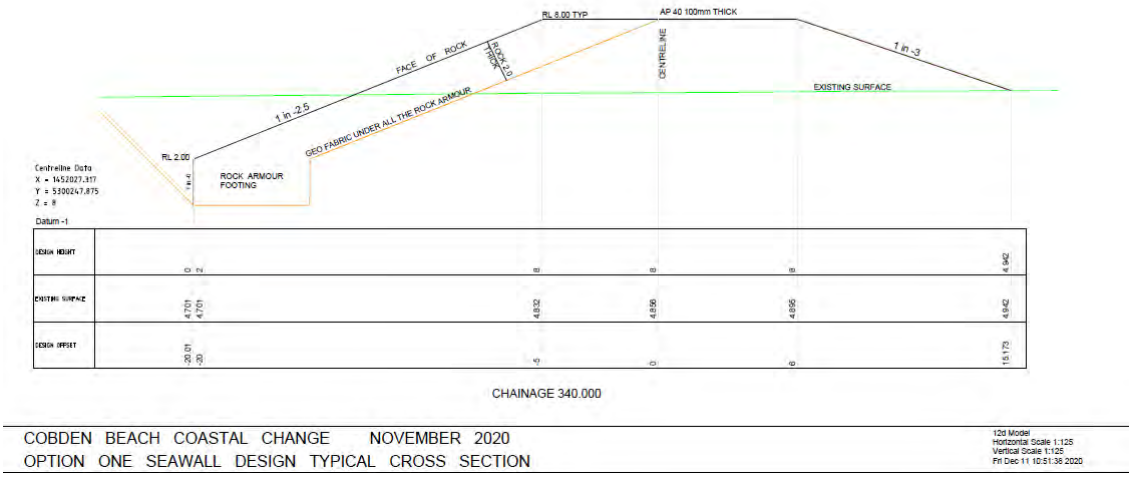

Figure 6. Option 1 typical cross section.

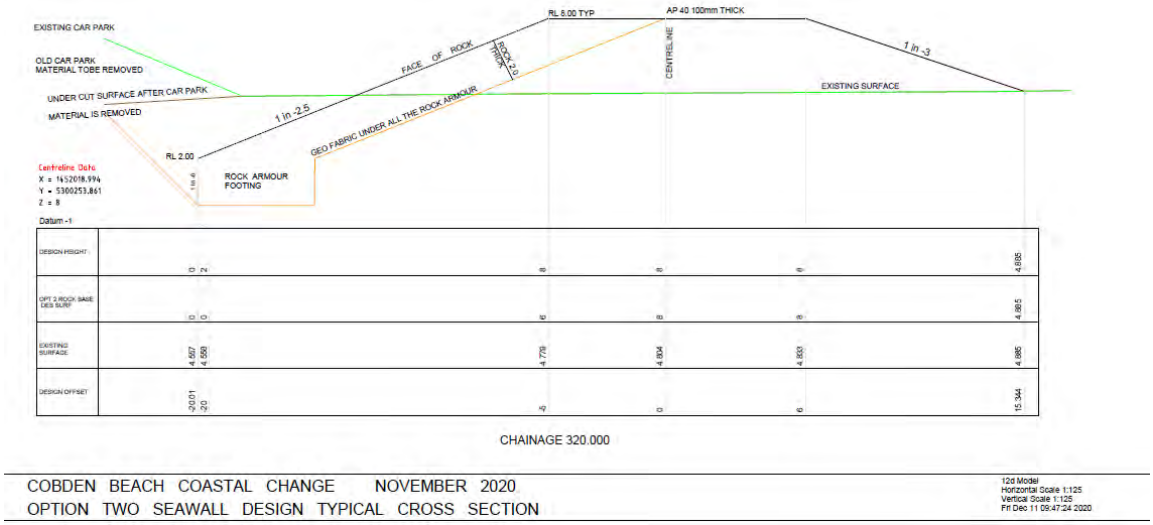

Figure 7. Option 2 typical cross section.

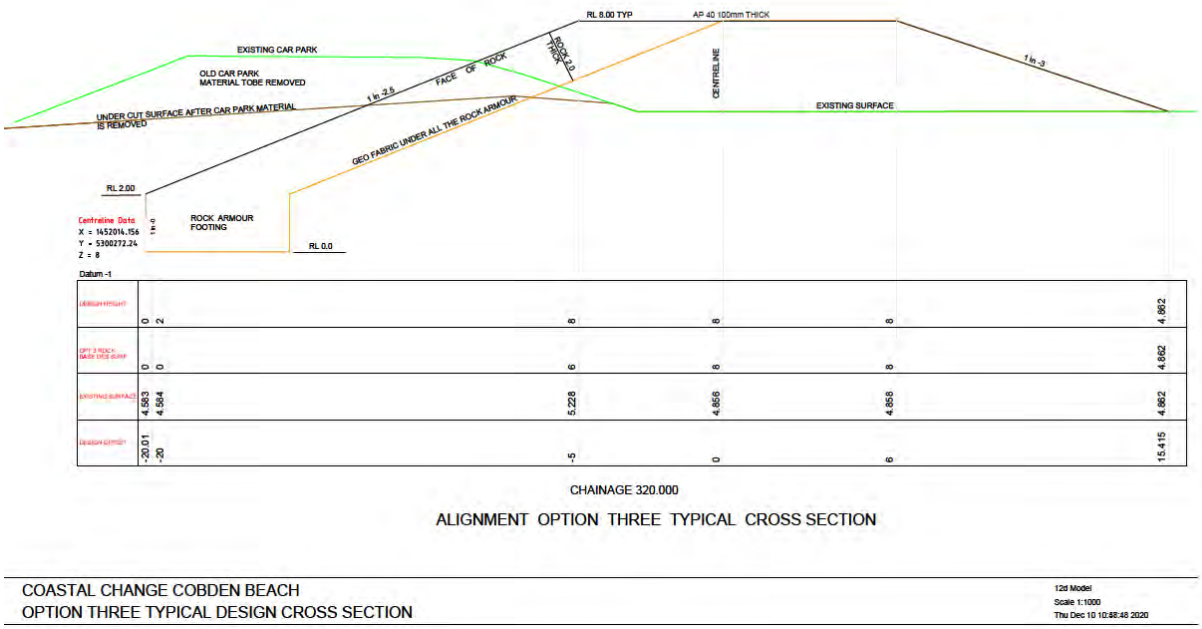

Figure 8. Option 3 typical cross section.

Jellyman Park Seawall Options contract costs		
	Initial contract costs	*Staggered costs*
Option 1: full	$4,000,000	
Option 1: staged	$2,700,000	$1,400,000
Option 2: full	$3,800,000	
Option 2: staged	$2,600,000	$1,300,000
Option 3	$3,700,000	*Undetermined annual maintenance costs*

Figure 9. Full and staged contract costs for the three seawall alignment options (updated August 2022). Note these costs are for comparison only. More accurate costs can only be determined once detailed designs have been produced.

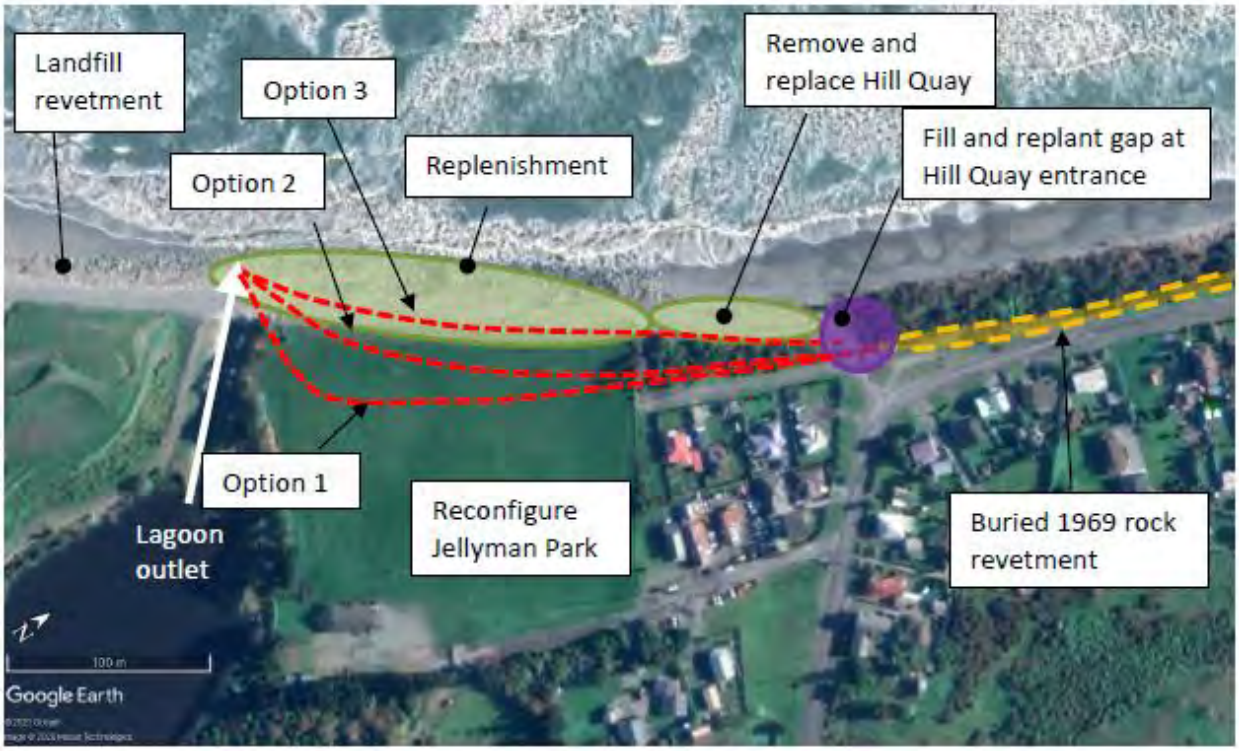

Figure 10. Short to medium-term options to manage coastal change at Cobden Beach [From: *Coastal Change at Cobden Beach, Greymouth. NIWA, April 2020*].

Greymouth Floodwall Rating District 2021-2024 Asset Management Plan

West Coast Regional Council

388 Main South Road
Greymouth
7805

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1.0 Purpose of this Document

The purpose of this document is to summarise the management philosophy that is applied to the Greymouth Floodwall Rating District including the infrastructure assets and services. This approach ensures that acceptable levels of service are provided in the most cost-effective manner and contribute to the achievement of the community outcomes identified in the West Coast Regional Council's Long-Term-Plan (LTP).

This AMP defines the objectives and performance standards of the Greymouth Floodwall Rating District for which the West Coast Regional Council bears the maintenance responsibility, including providing a basis upon which the effectiveness can be measured. The key purposes of this AMP are to:

- Provide a history of the Greymouth Floodwall protection scheme.
- Convey the long-term strategy for the management of the Greymouth Floodwall Rating District.
- Provide a tool to assist with management assets in a cost effective and sustainable manner.
- Manage the environmental, service delivery and financial risks of asset failure.
- Demonstrate that the service potential of the rivers and drainage assets is being maintained.

2.0 Asset Management Objectives

West Coast Regional Council recognises that the Greymouth Floodwall Asset Management Plan is the fundamental driver of flood protection for the scheme. This AMP has been developed in accordance with the Local Government Act 2002, with the first AMP completed in 2003 with three yearly updates or earlier where information indicates a significant change from what is stated in the current AMP.

In order to fulfil the outcomes, vision, goals and objectives of these assets, the West Coast Regional Council have adopted a systematic approach to the long-term management of its assets and services on the Greymouth Floodwall by preparing this AMP.

West Coast Regional Council is committed to best appropriate practice asset management in order to achieve the following key objectives:

- Meet the service expectations of the Greymouth Floodwall community.
- Ensure maintenance activities achieve efficient results with optimal benefits.
- Demonstrate Council's approach to managing risk and meeting growth requirements towards a sustainable future.
- Comply with all statutory requirements.

3.0 Greymouth Floodwall Background

From the earliest days of settlement, the communities of Greymouth, Blaketown and Cobden have been exposed to the risk of flooding from the Grey River.

Major floods have occurred in 1867, 1868, 1872, 1884, 1887, 1897, 1905, 1936, 1940, 1967, 1970, 1976, 1977 and 1978. In the late 1970's the Westland Catchment Board began investigative work on the development of flood protection measures for these communities.

On March 25, 1985, the Westland Catchment Board presented an updated report and design, indicating an approximate cost of $3 million. The design embodied a set of strategically placed stopbanks intended to contain a Grey River flood peak of 5,500 cumecs which at that time was estimated to have a return period in the order of 50 years. Financial approval was sought from Government and in December 1986, the approval for a $3.2m scheme was given on the basis of 60% Government funding/ 40 % local funding.

Work commenced in 1986 but during the construction of the Cobden stopbanks two major floods occurred on 19 May and 13 September 1988 which caused extensive inundation and consequential damage. These events gave both urgency to the completion of the project and the need to re-assess the scheme standard. The technical review which ensued resulted in the upgrading of the scheme design to 6,100 cumecs with 900 mm of freeboard. The revised scheme represented a re-assessment of the peak flow expected with an average annual exceedance probability of 2 % i.e. a retention of the 50 year return period flood capability.

This amended proposal was forwarded to Government and approval for an upgraded $4.2m scheme was approved on the basis of 80% Government funding/20% local funding.

The first contract was let for the Cobden Stage 1 stopbank in November 1986 and the final contract for the raising of the Blaketown Tiphead Road was completed in September 1990. It was completed at an overall cost of $4m. (80% Government/ 20% Grey District Council).

Since the completion of the protection works the system has experienced flood flows in excess of 5,500 cumecs on two occasions i.e. 5,812 cumecs (16 December 1997) and 5,667 cumecs (19 October 1998). Although some minor seepage was observed, in several places, through and beneath the scheme stopbanks during such events the structures have performed satisfactorily and averted what would otherwise have been widespread flooding and consequential damage to these communities. Concerns had been expressed by sections of the Cobden community relating to the extent of seepage observed during major floods and the implications that this might have for the structural integrity of the stopbanks.

Acting on these concerns the West Coast Regional Council commissioned an investigation of the stopbank. The purpose of this investigation was to assess the nature, cause, potential threats and remedies for the seepage problem and report findings to the Greymouth Joint Flood Wall Committee which is a joint committee of both the Grey District Council and the West Coast Regional Council.

The investigation was undertaken by Civil and Environmental Consulting Ltd. and resulted in "Greymouth Flood Protection System Integrity Report" (31 March 1999). This report concluded that there was a need to modify the Cobden stopbank to incorporate seepage control measures in order to lessen the risk of seepage induced instability. This strengthening works were carried out in 2000. The

report also recommended that consideration be given also to a re-evaluation of hydraulic capacity of the system using updated river flood flow and tide information.

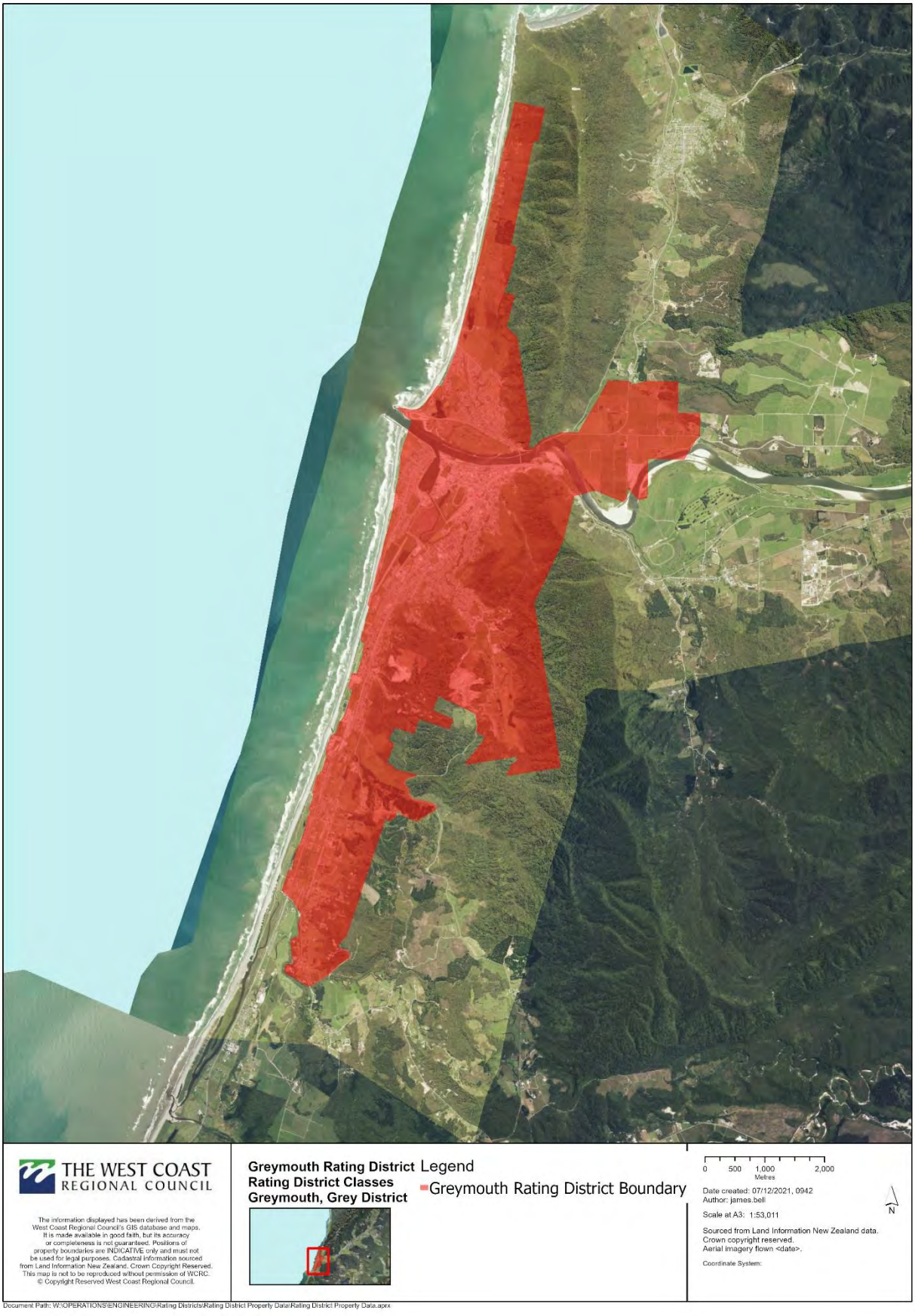
As a result, the return period for the scheme design capacity event of 6,100 cumecs was determined to be in the order of 30 year event, rather than a 50 year event as previously calculated. As a result of the revised analysis, the Joint Floodwall Committee, in 2006, decided to design an upgrade to the floodwall to a new service level of 6,600 cumecs (the revised 50 Year Return Period Flood Event) with 600mm freeboard.

As a result of further deliberations by the Joint Floodwall Committee, it was decided to apply for a second option of a higher threshold to the 7,400 cumecs flow with 600 freeboard, which equates to a 150 year design flood. This would ensure that future development of the structure, if required, would not require additional resource consent. Resource consents for this were applied for in 2006 and were granted in December 2008. Tenders for this work were let in 2009, and work was completed in 2010 to the 50 year event level with concrete work to the higher 150 year level.

It is anticipated that in future the community will wish to bring the entire wall up to the higher flood protection level.

As a result of the community consultation for the Long Term plan in 2021, council resolved to extend the Greymouth Rating District boundary to include Coal Creek and New River Rating Districts. The assets of these two schemes will now be administered under the Greymouth Rating District.

3.1 Greymouth Rating District Map



4.0 Description of Assets

Asset	Quantity	Unit	Rate
Rock	46874.5	Tonne	Various
Fill	172436	M^3	$36.60
Rubble	3168	Tonne	Various
Top Course	3890	M^3	$41.70
Ancillary	99330.72	Various	Various
Asset value			$ 13,760,193.89
Contingencies			$ 1,376,019.39
Resource Consents			$ 302,724.27
Emergency Work Conditions			$ 1,376,019.39
Asset Value			$ 16,814,956.93

4.1 Physical Assets

Asset Type	# of Assets	Asset Components	Quantity	Rate	Value	Total Value
Floodgate	2	Ancillary	15.2	Various	$65,994.00	$65,994.00
Riprap	1	Rock	33709.5T	Various	$2,602,335.50	$2,602,335.50
Stopbank	9	Fill	170466m^3	$36.60	$6,239,055.60	$10,634,324.77
		Rock	10955T	Various	$614,715.00	
		Rubble	3169T	Various	$216,642.00	
		Top Course	3890m^3	$41.70	$162,213.00	
		Ancillary	97285.52	Various	$3,319,809.67	
Contract variations		Ancillary	2030	Various	$449,303.62	$461,813.62
		Rock	180T	Various	$12,510.00	
Total						$13,760,193.89

4.2 Asset Map

Note: Not all assets have been added to the asset map due to having no spatial data to represent them.

5.0 Existing Standard

The scheme now protects the town from a 6,600 cumec flood event (the revised 50 Year Return Period Flood Event) with 600mm freeboard. A flood of this size has a 2% chance of occurring in any given year. Parts of the floodwalls (the concrete sections) have been built up higher to the 7,400 cumec plus freeboard level in anticipation that the community will eventually wish to build the earth structures up to this higher protection level.

5.1 Service Level

The Levels of Service represented in this AMP are described and aligned with community values including affordability, quality, safety, community engagement, reliability and sustainability. Councils in New Zealand will generally adopt one of three methods for determining the level of service provided by a scheme:

- Agreeing on a scope of physical works with the community without reference to a target capacity or return period (low risk schemes)
- Providing physical works with a level of performance provided in terms of a target capacity (medium risk schemes)
- Providing physical works with a level of performance in terms of a target return period (high risk schemes)

Each of the three methods for determining the level of service may be suitable for a given scheme, provided that communities understand event likelihood, scheme and property vulnerability, potential consequences, and residual risk.

Where council staff have recommended physical works or analysis that did not proceed due to community resistance to cost, then councils are only able to track their service delivery through measures around maintenance works programmes or a general description of asset condition.

A key level of service for the Greymouth Floodwall is to prevent flooding of the townships of Greymouth, Cobden and Blaketown from the Grey River for flood events up to 6,600 cumecs.

5.2 Maintenance Programme

The maintenance of the Greymouth Floodwall can be broken into two categories:

1. Stopbanking
2. Erosion Control

Stopbank Maintenance

Maintenance includes repair of any scouring, vegetation removal to facilitate access and to optimize berm flow, control of vehicle access to prevent damage to stopbank batter slopes, topping up of stopbanks as required to maintain stopbank capacity in terms of design, maintenance of grass cover, maintenance of drainage provision, routine and flood surveillance operations and reporting.

Construction of drainage and sewage lines and other utility services that penetrate the bank provide potential lines of weakness through the structure. Unless proper precautions are taken in the design and construction of these penetrations there is a risk that they may become preferential lines for seepage flow. Where pressurised pipelines such as pumped drainage outfalls are installed or malfunctioning floodgates exist premature saturation of the stopbank core can occur under flood

conditions which in turn may lead to a loss of strength from elevated soil pore water pressures or induce internal erosion of the stopbank core or its foundation.

Stopbanks can be damaged in the event of an earthquake by cracking where displacement occurs, or by liquefaction of the foundation material. These actions may result in subsidence, slumping or spreading. The probability of seismic damage coinciding with a flood is considered remote.

Erosion Control Works

Erosion control works consist of continuous rock rip rap facings of specific sections of stopbanking. Erosion control facings are designed and constructed to provide protection to the stopbanks core from the river's erosive forces during floods.

Rock is used in the formation of these facings of the required grading to resist the forces (velocity) of the river. Routine maintenance ensures the coverage and stability of rock rip rap on stopbanks is maintained to lessen the risk of failure.

Any slumping of rock rip rap is topped up with rock that has acceptable durability, angularity and appropriate grading to provide the required protection to the underlying structure.

Where slumping of rock rip rap facings has occurred, an assessment needs to be made to ascertain cause prior to remedial works being executed in order to ensure as far as is reasonably practical the failure mechanism is thoroughly understood and an appropriate remedy found.

An annual maintenance programme will be prepared each year in consultation with the Joint Floodwall Committee prior to adoption by the Regional Council for inclusion in the Annual Plan.

In preparing the annual maintenance programme consideration will be given to:

- An inspection to identify works requiring immediate repair.
- Works anticipated as being required given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Surveillance, reporting and investigations

An annual report will be presented to the Joint Flood Wall Committee outlining maintenance expenditure for the financial year.

5.3 Damage Exposure

River control works are constructed in a very high energy environment with the purpose of resisting and absorbing some of that energy. It is considered that no matter what the standard of maintenance carried out, it is inevitable that damage will occur to structures.

In the years since their construction the sections of bank faced with rock riprap have been exposed to three flood events with flows in excess of 4,000 cumecs without appreciable damage.

The mean annual flood of the Grey River at the Dobson hydrometric station is currently estimated at 3,840 cumecs. Whilst the possibility exists for premature failure of the stopbanks, performance to date indicates that the most likely cause of failure will be over topping with flows in excess of the design capacity.

Event size (AEP)	Value	Damage ratio	Damage exposure	Prudent Reserve	Prudent reserve contribution
10%	$16,814,956	2%	$336,299	$336,299	100%
5%	$16,814,956	4%	$672,598	$470,818	70%
2%	$16,814,956	8%	$1,345,197	$672,598	50%

It has been deemed, within reason, that all Rating Districts have a prudent reserve target balance that contributes to at least 100% of the damage exposure for a 10% AEP event, 70% for a 5% AEP event and 50% for a 2% AEP event. These percentages define what is an appropriate and acceptable level of risk for Council and the community.

5.4 Prudent Reserve

Why do we need a prudent reserve?

- Minimise the financial impact of unplanned works, such as those caused by weather events
- Ensure the rating district is able to contribute funding that is sustainable and affordable
- Ensure Council's debt level is managed, and that borrowing is still available when required
- Ensure the debt levels of the rating district do not exceed the ability to fund the repayments

This target balance for the 'prudent reserve' for this rating district is $250,000 as agreed by council. This prudent reserve is immediately available. It is likely the current reserve will only cover a portion of the actual cost of the potential damage that could occur.

If an event were to occur and the prudent reserve does not cover the full repair and rebuild cost of the assets, it is understood by the community that the remaining costs will be paid by loan or the rating district accounts will be in overdraft. In the instance of extreme weather events, NEMA funding and the Councils private insurance will be accessed for cost recovery if the criteria are met. The West Coast Regional Council's insurance policy has a $400,000 excess. 40% of eligible rebuild costs will be met by this policy.

Below are the key criteria that needs to be met to access the NEMA funding, which can cover up to 60% of eligible rebuild costs

The provisions for government financial support to local authorities apply whether or not a state of emergency is, or has been, in force

Government assistance will not normally be available for assets which receive a subsidy from any other source, unless:

- *the local authority has adequately protected itself through asset and risk management including mitigation, where appropriate, and the proper maintenance of infrastructure assets, or*
- *the local authority has made sound financial provisions (such as the provision of reserve funds, effective insurance or participation in a mutual assistance scheme with other local authorities) to a level sufficient to ensure that the local authority could reasonably be expected to meet its obligation to provide for its own recovery*

Threshold

Threshold for reimbursement; As with other response claims, Government policy is to reimburse 60 percent of the combined eligible costs (response and essential infrastructure costs), above the following thresholds:

- *0.0075 percent of the net capital value of the city council, district council or unitary authority involved*
- *0.002 percent of the net capital value of unitary authorities where the assets in question are of a type that ordinarily are managed by regional councils, or*
- *0.002 percent of net capital value in the case of regional councils*

6.0 Funding

6.1 Maintenance

Maintenance is funded by targeted rates, the level of rating being determined each year in the Annual Plan process. This involves:

a) Preparation of an annual works programme and corresponding budget in consultation with the Greymouth Joint Floodwall Committee.

b) Adoption of the annual works programme and budget by the Greymouth Joint Floodwall Committee.

c) Discussion of the works report and budget with the ratepayers.

d) Adoption of final budget in the Council's Annual Plan.

The aim of maintenance is to ensure the infrastructure assets are kept at a standard where they can always perform to their service level. Where rock is required to be placed on an existing stopbank under direct attack from the river, the protection required to maintain the existing stopbank at its same service potential would be charged to the scheme maintenance account.

Capital works are generally defined as works which increase the service level of the scheme. Such work would include increasing the design standard or the area covered by a scheme and works to increase security or performance of an erosion control system or structure over and above that identified in the asset plan.

6.2 Damage Repairs

Routine damage repairs are funded by a combination of:

a) Carrying out work as scheduled in annual works programme.

b) Reprioritising works identified in the annual works programme.

c) Use of financial reserves.

Major damage repairs would be funded by loans raised by the Council and repaid by targeted rating over a number of years.

6.3 Financial Reserves

Financial reserves are held within the rating district account to:

a) Meet the costs of unscheduled works.

b) Enable an immediate response to flood damage repairs.

c) Prevent major fluctuation in rating levels annually.

The levels of financial reserves held in the rating account are determined by the estimated damage exposure and the likely need for un-programmed works.

6.4 Depreciation

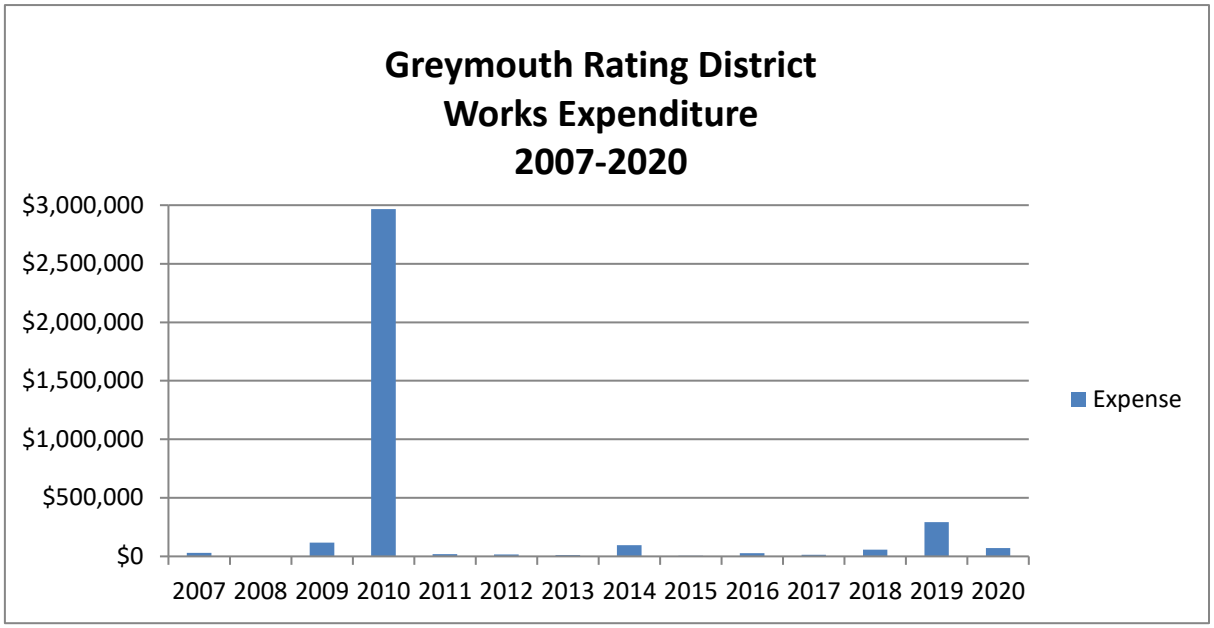
River control schemes are designed to be maintained in perpetuity by constantly repairing and replacing component parts which are damaged by floods or by the constant wear and tear encountered in a river environment.

The performance measure is that the infrastructure assets are maintained to meet their service levels at all times.

As there is a constant cycle of replacement of elements of the infrastructure as necessary, depreciation of the value of the assets is not appropriate and funding of depreciation is not necessary. This approach is consistent with the NZ Infrastructure Asset Valuation and Depreciation Guidelines, Section 5.4.4.

6.5 Works Expenditure Greymouth

This chart reflects the construction costs of infrastructure assets on the Greymouth Rating District.
This chart **does not** reflect the total annual expense incurred by the Greymouth Rating District.
Please refer to the annual works and financial report for the total expenses.



Expenditure 2007 - 2020	
Total expenditure	$ 3,725,185.73
Average expenditure	$ 266,084.70
Total asset value	$16,820,179.76

7.0 Performance Measures

The overall performance measure is that the infrastructure assets are maintained to meet their service levels at all times. This includes:

1. Ensuring all floodbanks continue to protect the town from a 6,600 cumec flood event plus freeboard.
2. Maintaining rock rip rap facings and grass cover on stopbanks to prevent active erosion of the stopbank core.
3. Maintaining stopbank drainage systems to control seepage flows and prevent internal erosion of the stopbank core and foundation and loss of stability.

The following procedures may be adopted to ensure the adequacy of maintenance.

Period	Procedure	Performance Measure
Annually	Produce annual works reports for the rating district to include type of work to be undertaken, quantities, location and costs.	1. No reports of reduced freeboard anywhere along the stopbank system, without an agreed hydraulic and hydrological investigation in progress and a precursor to consideration of appropriate response measures. 2. No reports of: - stopbanks and bank protection erosion requiring repairs - sand size or greater erosion products being present in seepage flows exiting the stopbanks or their foundations under flood conditions - Increasing seepage flows exiting the stopbanks or their foundations under flood conditions - obstructed stopbank drainage facilities - Cracking of stopbank crest - Evidence of slumping or foundation heave Without an agreed programme of remedial work in progress.
	Organise contracts for agreed scheme work, oversee contract completion and report to Council.	
	Report on works undertaken during the previous financial period to the rating district ratepayers and Council.	
	Inspect all works and prepare a maintenance programme and budget.	

Decennial	Re-survey all river cross-sections between the Grey River mouth and the Cobden bridges and re-evaluate the hydraulic capacity of the stopbank system and report findings against the current design standard.	Report to Council and ratepayers on revaluation of assets and the Plan review.
	Re-measure cross section river profiles and carry out a comparative analysis with preceding surveys to establish possible bed level trends and effects on flood carrying capacity.	
	Carry out an assessment of hydrology at the Dobson recorder and update for scheme design discharge and report findings.	
	Revaluation of the existing infrastructural assets to include any additional volumes to stopbanks and bank protection works from previous reviews.	
	Critically evaluate the performance of the stopbank under service conditions with particular emphasis on seepage control and stability.	

7.1 AMP Review and Monitoring

This plan is a living document, which is relevant and integral to daily activity. To ensure the plan remains useful and relevant the following on-going process of AMP monitoring and review activity will be undertaken:

- Formal adoption of the AMP by the West Coast Regional Council.
- Review and formally adopt Levels of Service to comply with the Joint Floodwall Committee.
- Revise this AMP three-yearly prior to the Long Term Plan (LTP) to incorporate and document changes to works programmes and outcome of service level reviews.
- Quality assurance audits of asset management information to ensure the integrity and cost effectiveness of data collected.
- Peer review and external audits will be undertaken to assess the effectiveness with which this plan meets corporate objectives. Periodic internal audits will be undertaken to assess the adequacy of asset management processes, systems and data and external audits will be undertaken to measure asset management and performance against ‘best practice’.

Legend

Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

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0 0.125 0.25 0.5
Kilometers

98

PROJECT	MAP TITLE	REVISION	DATE
Cobden Sea Wall Modelling	**DRAFT Results - 1% Stormtide Current Climate**	**01**	**21 January 2021**
		A3 SCALE **1:10,000**	AUTHOR **Matthew Gardner**

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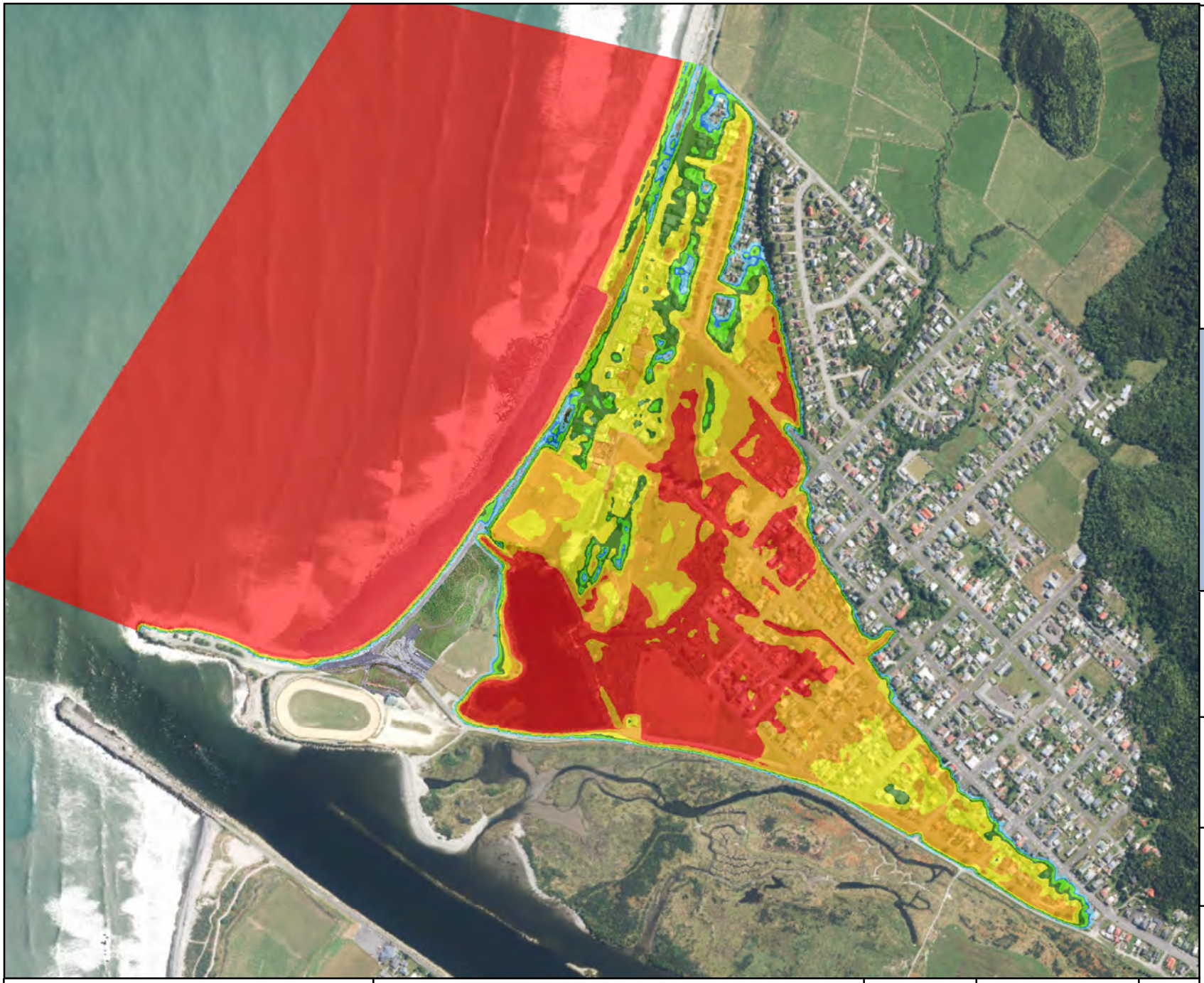

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0 0.125 0.25 0.5
Kilometers

99

PROJECT	MAP TITLE	REVISION	DATE
Cobden Sea Wall Modelling	**DRAFT Results - 1% Stormtide 0.5m Sea Level Rise**	**01**	**21 January 2021**
		A3 SCALE **1:10,000**	AUTHOR **Matthew Gardner**

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