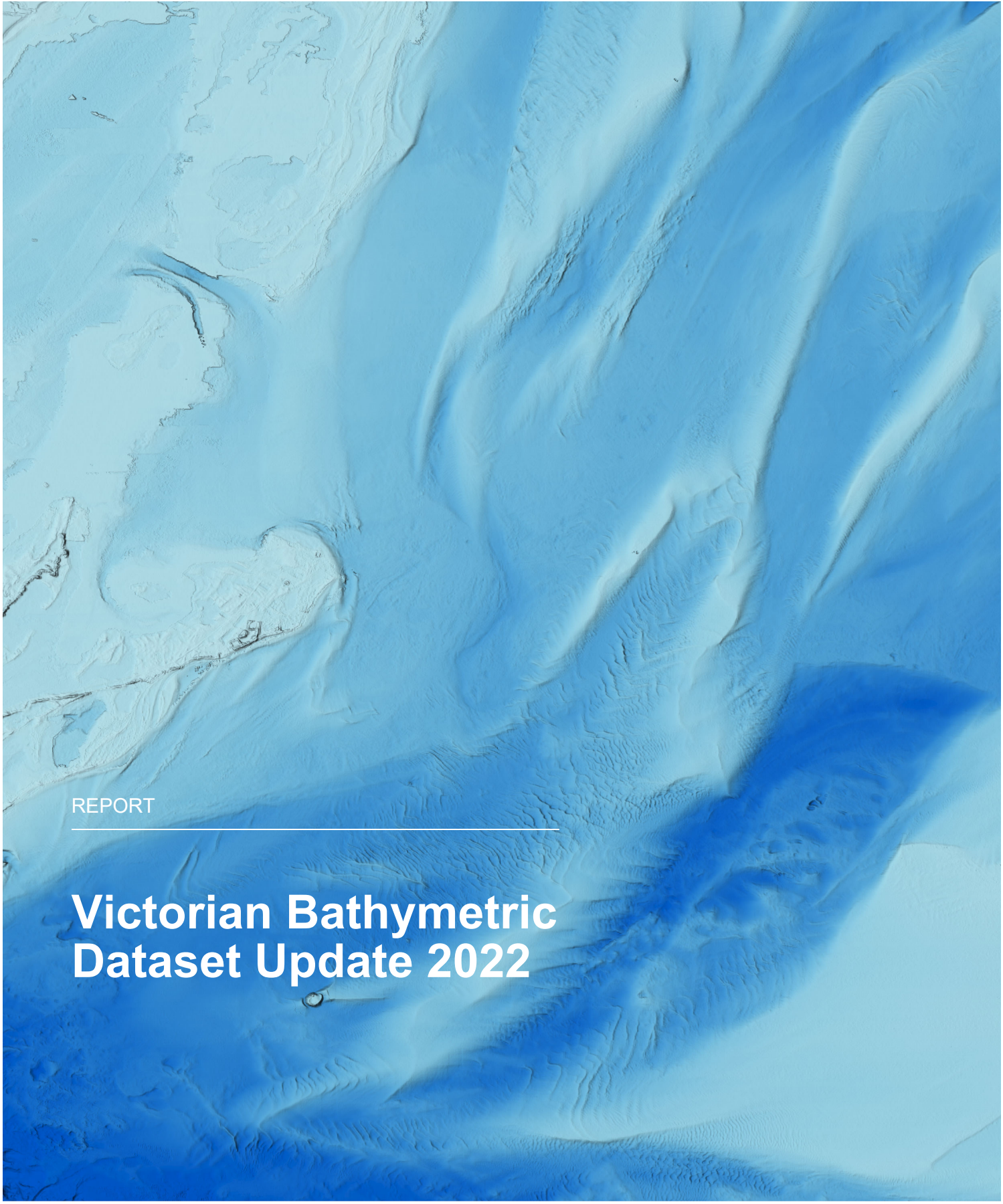

REPORT

Victorian Bathymetric Dataset Update 2022

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veris

Contents

1. Introduction

Veris was engaged by the Department of Environment, Land, Water and Planning (DELWP), State Government of Victoria, to process updates to the Victorian Bathymetric Dataset for 2022.The Victorian Coastal Digital Elevation Model 2022 (VCDEM) incorporates several new datasets to previous versions of the dataset created in 2017 and 2010, integrating new bathymetric datasets to the VCDEM product. The VCDEM dataset is foundational to the Victorian Coastal Mapping Program (VCMP) and updates to the VCDEM will improve the understanding of dynamic coastal processes and their associated risks advanced by the VCMP.

The VCDEM2022 produced by Veris is comprised of two major outputs:

1. HIGH RESOLUTION VCDEM2022

Contains gridded data sources with a gridded spatial resolution (pixel size) equal or superior to 10m in addition to vertical uncertainty meeting IHO Order 1b specifications (ie better than 0.5m). The high resolution VCDEM2022 will necessarily contain gaps where data does not meet these conditions.

2. SEAMLESS VCDEM2022

Contains gridded data sources with a gridded spatial resolution (pixel size) equal or superior to 10m in addition to vertical uncertainty meeting IHO Order 1b specifications (ie better than 0.5m). Low resolution bathymetric data is used in areas with no high resolution bathymetric coverage and algorithms are used to merge bathymetric to a seamless product.

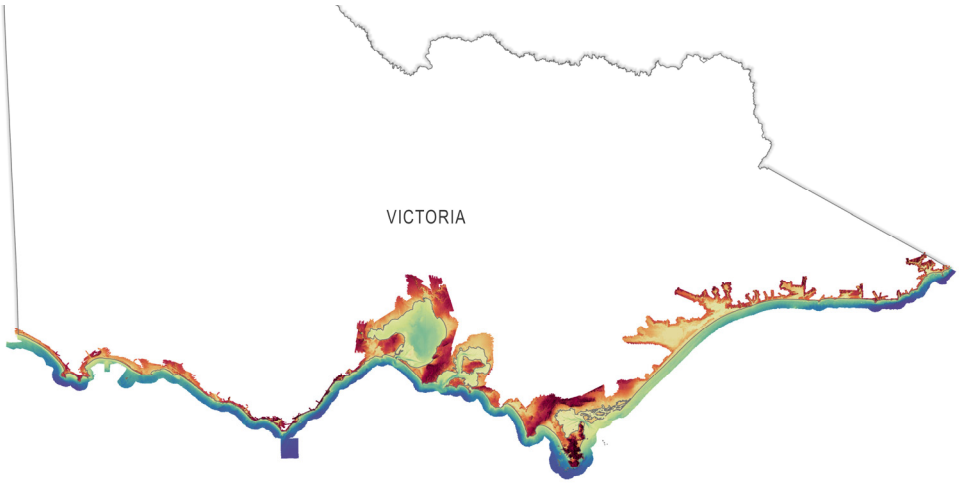

FIGURE 1 EXTENTS OF VCDEM2022

2. Data

The VCDEM2022 update integrates newly captured bathymetric data with previously created VCDEM iterations (2017 and 2010). Data was selected for inclusion to the VCDEM2022 based on horizontal and vertical accuracy criteria. Firstly, projects needed to have a gridded spatial resolution (pixel size) equal to or superior to 10 metres. Secondly, projects needed to meet IHO Order 1b Total Vertical Uncertainty requirements, namely vertical accuracy equal to or superior to 0.5 metres. Projects which met minimum requirements for inclusion in VCDEM2022 are listed in Table 1.

Project	Source	Gridded resolution (metres)
apollo_cmr_2mbathy_gda2020_mga54_ahd.asc	Deakin	2
helensrock_2mbathy_gda2020_mga54_ahd.asc	Deakin	2
merri_srl_1mbathy_gda2020_mga54_ahd.asc	Deakin	1
peterboroughcompartment_box01_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box02_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box03_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box04_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box05_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box06_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box07_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box08_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box09_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box10_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
peterboroughcompartment_box11_2mbathy_gda2020_mgaz54_ahd.asc	Deakin	2
portfairy_waveenergy_50cmbathy_gda2020_mga54_ahd.asc	Deakin	0.5
portlandcompartment_box01_2mbathy_gda2020_mgaz54_ahd.	Deakin	2

Project	Source	Gridded resolution (metres)
asc		
bunurong_2mbathy_gda2020_mga55_ahd.asc	Deakin	2
popeseye_2mbathy_gda2020_mga55_ahd.asc	Deakin	2
portseahole_2mbathy_gda2020_mga55_ahd.asc	Deakin	2
ppb_9ftbank_1mbathy_gda2020_mga55_ahd.asc	Deakin	1
ppb_carrumbight_1mbathy_gda2020_mga55_ahd.asc	Deakin	1
ppb_driftalgae_s1_2mbathy_gda2020_mga55_ahd.asc	Deakin	2
ppb_driftalgae_s2_2mbathy_gda2020_mga55_ahd.asc	Deakin	2
ppb_margaretsreef_1mbathy_gda2020_mga55_ahd.asc	Deakin	1
ppb_tedesco_1mbathy_gda2020_mga55_ahd.asc	Deakin	1
ppb_wilsonsspit_1mbathy_gda2020_mga55_ahd.asc	Deakin	1
PoMCDATA	PoMC	10
PortFranklin_v3	GP	SBES
BarryBeach	GP	SBES
SundayIsland	GP	SBES
Bairnsdale_v2_1	GP	SBES
McLennanStraitWestern	GP	SBES
AvonRiver	GP	SBES
WinganInlet	GP	SBES
TamboonInlet	GP	SBES
SydenhamInlet	GP	SBES
SnowyRiver	GP	SBES
ShallowInlet2017	GP	SBES
MallacootaInlet	GP	SBES
AndersonInlet3	GP	SBES
LakeTyers2	GP	SBES

TABLE 1 PROJECTS SELECTED FOR INCLUSION IN VCDEM2022. POMC IS PORT OF MELBOURNE CORPORATION, GP IS GIPPSLAND PORTS, SBES IS SINGLE BEAM BATHYMETRIC MODEL.

DELWP identified several Single Beam Echo Sounder (SBES) hydrographic surveys performed by Gippsland Ports as having high potential to supplement areas in eastern Victoria which are poorly covered by other high resolution bathymetric surveys. DELWP requested the incorporation of the SBES to the VCDEM2022, a variation to the initial scope

of works, and Veris updated processing methods for their inclusion.

Veris included Port of Melbourne Corporation (PoMC) data into VCDEM2022 despite PoMC data being captured on chart datum rather than the preferred AHD. Conversions between chart datum and AHD are well described in Port Phillip Bay and converted data met the accuracy conditions (IHO Order 1b) for inclusion in VCDEM2022.

Figure 2 Highlights the spatial extents of the new bathymetric projects included in VCDEM2022 by Veris in the Victorian Bathymetric Dataset Update 2022 project.

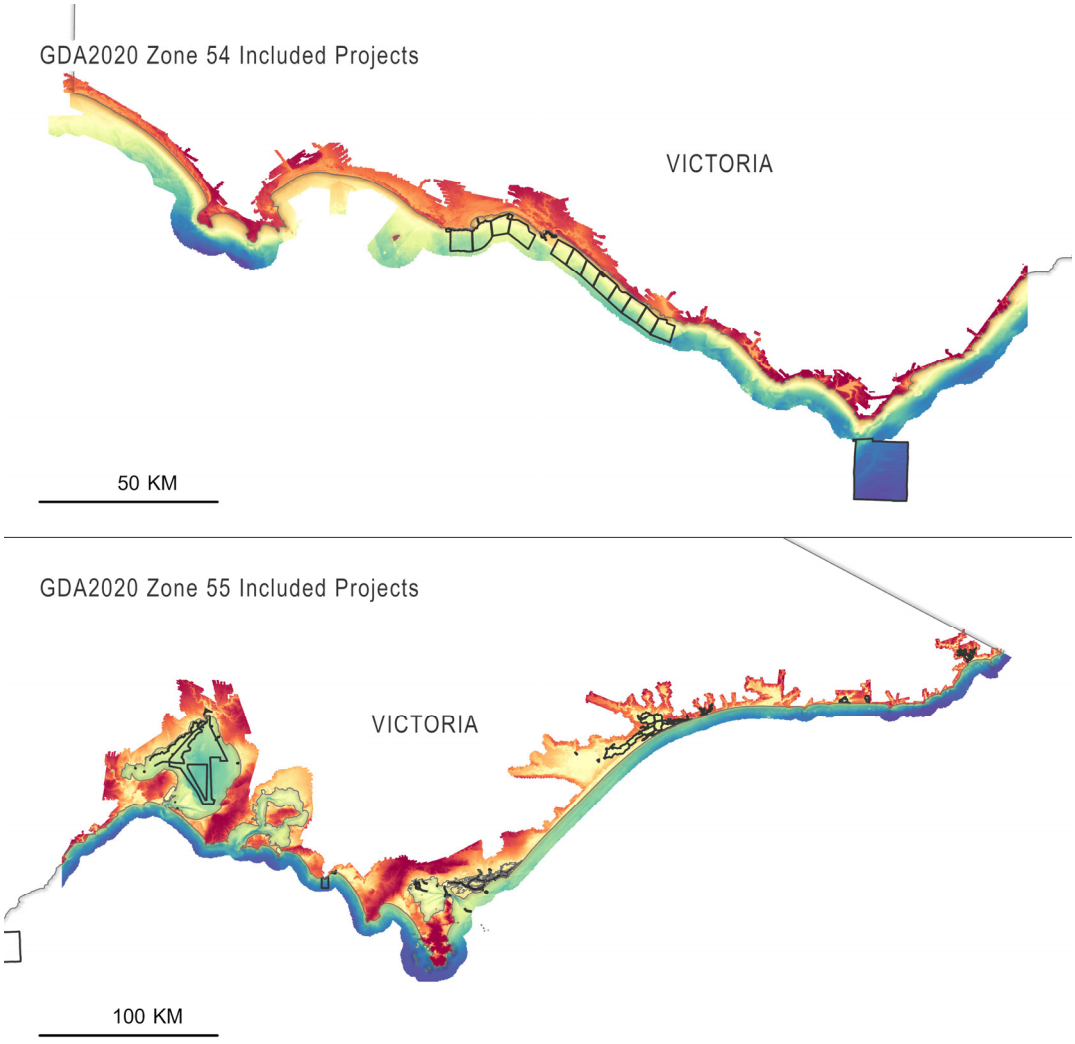

FIGURE 2 OVERVIEW OF UPDATES APPLIED TO VCDEM2022.

3. Method

3.1. Method for assessing inclusion in VCDEM

Two criteria were used to assess the suitability of new dataset for inclusion to the updated VCDEM2022, namely: the gridded horizontal resolution (pixel size) of the bathymetric dataset needed to be equal to or superior to 10 metres, and the vertical uncertainty of the bathymetric dataset need to meet IHO Order 1b specifications—vertical uncertainty better than or equal to 0.5 metres. Gridded horizontal resolution is validated by measurement of point spacing. Vertical uncertainty is measured by comparison to existing datasets.

3.2. Handling of Single Beam data

Single beam bathymetry data captured by Gippsland Ports was identified for inclusion into the VCDEM2022. Survey lines were integrated into Triangular Irregular Networks (TINs) for each project area to create bathymetric surface of the project area for ingestion to VCDEM2022. Coastline files were used as project boundaries to prevent the formation of triangles crossing over land and manual edits were made in some areas to further constrain the creation of triangles to regions of valid bathymetric data. Bathymetric TINs were then inspected for irregularities and errors before being rasterised for inclusion in VCDEM2022.

3.3. Method of integration to VCDEM

HIGH RESOLUTION VCDEM2022

The High Resolution VCDEM2022 utilised Mosaic dataset operators in Esri ArcGIS Pro software for product creation. Mosaic datasets are an ideal way to manage multiple large rasters and integrate them into a single product. Cell sizes, spatial reference, and NoData values are predefined in the Mosaic dataset before ingestion of all rasters.

The Mosaic dataset permits the ordering and layering of rasters to define the correct integration of datasets to the VCDEM2022. As the base layer to be updated, VCDEM2017 is placed at the bottom of the Mosaic with new rasters layered on top to update bathymetric depth values. Where new data overlaps each other, priority was given to projects which were more current, with consideration to the key indicators of gridded resolution and vertical uncertainty.

Mosaics were produced using the “First” operator to layer projects without edge blending to create a surface using only the best and most recent data. Exported mosaics were then converted into tiled Esri Grid format files for distribution.

SEAMLESS VCDEM2022

The seamless VCDEM2022 also used the Mosaic dataset to manage the integration of new rasters to create a seamless VCDEM2022.

Data was integrated into the Seamless VCDEM2022 mosaic in the same way as the high resolution and layer orders were maintained across both products. The Seamless VCDEM2022 differs from the High Resolution VCDEM2022 by using a mean filter to create

the surface and smooth edges between projects, minimising ‘steps’ between projects of differing vertical uncertainties to create a natural appearance to the DEM. The advantage of these methods to those used in the VCDEM2017 is that all bathymetric measurements are retained with algorithms determining the best ways to minimise steps. There is substantial scope to explore the different smoothing algorithms in the future and Veris presents a brief discussion of the advantages and disadvantages in its recommendations for future VCDEM updates.

Following the merging of projects, mosaics were exported and converted to Esri Grid format tiles for distribution.

METADATA

Veris produced metadata products for VCDEM to establish the lineage of datasets comprising VCDEM2022. The extents of the new bathymetric datasets were polygonised and compiled into a single vector dataset with known details of the project included as attributes. The compilation to metadata is a variation to the original scope of works by Veris.

4. Results

The project resulted in the creation of updated DEMs covering the coastal and landward regions of the Victorian coastline. Products were created under two VCDEM types, a High Resolution VCDEM2022 and a Seamless VCDEM2022.

Delivered products include the following:

1. **HIGH RESOLUTION VCDEM2022 PRODUCTS**

2.5m resolution Gaps GDA2020 zone 54 Esri Grid Tiles

2.5m resolution Gaps GDA2020 zone 55 Esri Grid Tiles

2.5m resolution Gaps GDA2020 zone 54 GeoTIFF

2.5m resolution Gaps GDA2020 zone 55 GeoTIFF

2. **SEAMLESS VCDEM2022 PRODUCTS**

2.5m resolution Gaps GDA2020 zone 54 Esri Grid Tiles

2.5m resolution Gaps GDA2020 zone 55 Esri Grid Tiles

2.5m resolution Gaps GDA2020 zone 54 GeoTIFF

2.5m resolution Gaps GDA2020 zone 55 GeoTIFF

10m resolution VicGrid2020 Esri Grid Tiles

10m resolution VicGrid2020 GeoTIFF

3. **METADATA PRODUCTS**

VCDEM2022_Project_Extents.shp

Victorian_Bathymetric_Dataset_Update_2022_Report.docx

4.1. Overview of updated areas

We now present several overviews to highlight the integration of data into the updated VCDEM2022.

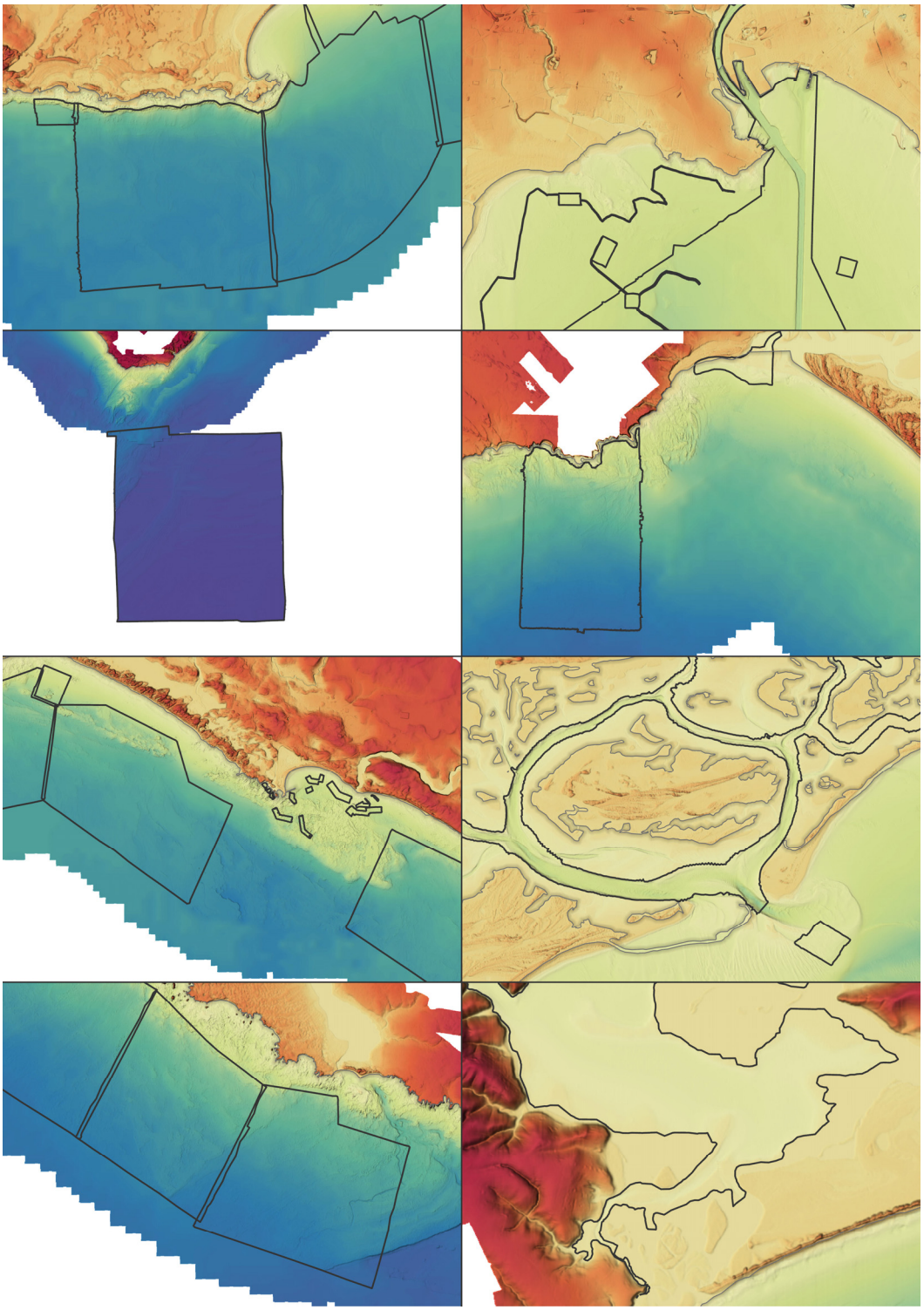

FIGURE 3 SELECTED EXCERPTS OF UPDATED PROJECTS IN VCDEM2022

5. Recommendations

Veris successfully updated the VCDEM by incorporating new bathymetric datasets to create VCDEM2022. Throughout the project, Veris noted areas in which VCMP may wish to consider for future updates of the VCDEM product.

RECOMMENDATION ONE: IMPROVE METADATA AND DATA LINEAGE

VCMP should consider collating metadata to cover each iteration of VCDEM. Since the initial release of VCDEM2010, the importance of detailed and accurate metadata has increased substantially. Compilation of metadata will allow stakeholders to trace the lineage of pixels in the VCDEM which will improve the usefulness of the data.

RECOMMENDATION TWO: MODERNISE VCDEM DATUM TO IMPROVE ACCURACY

VCMP may wish to consider a ground up reconstruction of the VCDEM. VCDEM2022 is comprised of bathymetric projects which cover a temporal span of over a decade since VCDEM2010. This period has seen a number of advances in geoid models in Australia which will affect the vertical accuracy of the topographic and bathymetric elevation datasets comprising VCDEM. A ground up reconstruction of VCDEM will be able to take advantage of newer algorithms for the source data and will ensure there is a unified processing pipeline and vertical reference of data comprising the VCDEM.

RECOMMENDATION THREE: IDENTIFY NEW TOPOGRAPHIC AND BATHYMETRIC DATA

VCMP should keep abreast of relevant new data captures which may have potential for inclusion in the VCDEM. The most important new datasets will be new multibeam bathymetric surveys; however, this project has highlighted the utility of single beam bathymetric surveys and there may be other suitable single beam bathymetric surveys—such as coastal transects. New topographic lidar surveys may also improve the currency of elevation data, particularly in dynamic regions, across the landward extents of the coastal zone.

RECOMMENDATION FOUR: IMPROVE SEAMLESS VCDEM MERGING

A ground up reconstruction of the VCDEM will allow a more accurate Seamless VCDEM to be constructed. The use of seamlines in the VCDEM will allow the use of localised blending criteria in the construction of the VCDEM. There may be areas of VCDEM where several bathymetric datasets have complex overlaps and, in these locations, localised blend widths can be applied to ensure the most desirable types of blending are applied where they are needed. The explicit definition of how to handle overlaps in a localised area will improve the Seamless VCDEM for stakeholders by selecting the best blend types for areas.

6. Conclusion

In the Victorian Bathymetric Dataset Update 2022, Veris successfully updated the Victorian Coastal Digital Elevation Model with newly captured high resolution bathymetric data. Two VCDEM products were developed in the project: the High Resolution VCDEM2022 containing the best and most recent bathymetric data and the Seamless VCDEM2022, optimised to minimise large elevation differences between projects and fill areas with no high-resolution data. The newly updated VCDEM2022 will assist the VCMP and their stakeholders by updating the VCDEM, improving access to high resolution bathymetric data sets in the coastal zone.

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