Hawkesbury City Council

attachment 1

to

item 152

Hawkesbury River Pre-dredging Investigations between Windsor and Sackville Ferry

date of meeting: 28 August 2012

location: council chambers

time: 6:30 p.m.

WorleyParsons

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HAWKESBURY CITY COUNCIL

Hawkesbury River Dredging Investigations

Summary Report

301015-02986

17 August 2012

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HAWKESBURY CITY COUNCIL
HAWKESBURY RIVER DREDGING INVESTIGATIONS
SUMMARY REPORT

Disclaimer

PROJECT 301015-02986 - HAWKESBURY RIVER DREDGING INVESTIGATIONS

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	N Cowlishaw	C Thomas	N/A	27-Jun-12	N/A	
B	Draft for discussion	N Cowlishaw	C Thomas	N/A	6-Jul-12		
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1 INTRODUCTION

The Hawkesbury River flows from the confluence of the Nepean and Gross Rivers, north of Penrith, for around 120 kilometres (km) to Broken Bay, where it enters the ocean. The river forms part of the greater Hawkesbury-Nepean River System, which effectively encircles metropolitan Sydney and provides its primary water source.

The Hawkesbury River is navigable from Windsor to the ocean and supports numerous recreational and commercial boating activities. The tidal stretch of the river from "The Breakaway" (upstream of the Windsor Bridge) to the Sackville Ferry river crossing (the project area; Figure 1-1) plays an important role hosting recreational boat users and providing a thoroughfare for vessels travelling to and from destinations further upstream.

The river is an important natural feature of the region that is highly regarded for its aesthetics and role in the local ecosystem. As such, efforts must be made to ensure safe, ongoing access for users of the river in a manner that also preserves the ecological attributes of the area.

Concerns from users of the river have been raised over a number of years in relation to the navigability of the project area. On 29 March 2011, Hawkesbury City Council resolved to present a report on dredging investigations to the Hawkesbury City Council Floodplain Risk Management Committee and requested that the Committee identify and prioritise potential locations for investigation along the Hawkesbury River between Windsor and Sackville that would provide the most cost benefit to the community.

On 18 April 2011, the Hawkesbury City Council Floodplain Risk Management Committee identified and prioritised seven locations within the project area for investigation, as follows:

1. Sackville Ferry
2. Sackville Gorge
3. Ebenezer Church
4. Pitt Town Bottoms
5. Sandy Point
6. Cattai Creek
7. Bens Point

Minutes of the Hawkesbury City Council Floodplain Risk Management Committee meeting on 18 April 2011 are provided at Appendix A.

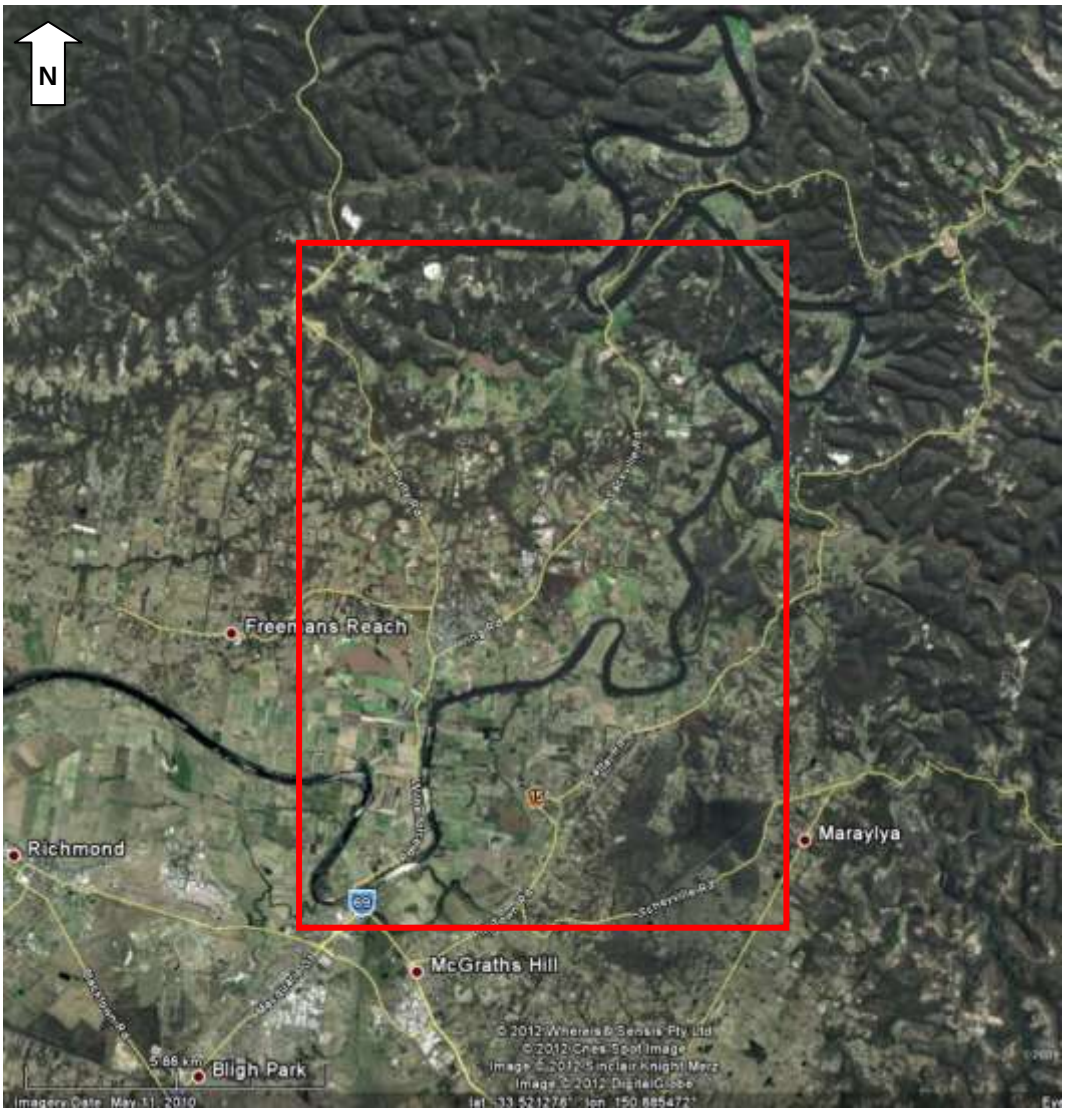

Figure 1-1: Hawkesbury River dredging investigation project area (source: Google Earth)

Hawkesbury City Council has received funding under the Waterways Program, matching Council's contribution, to undertake dredging investigations at the identified locations. The Waterways Program was introduced in 2008 by the then Land and Property Management Authority. The Program offered councils a share of up to $1million in funding to contribute dollar-for-dollar with councils on projects to improve recreational boat users' access to coastal rivers and estuaries. A further $500,000 in funding was offered in 2010. The purpose of the funding was to improve navigation along waterways through small to medium scale dredging activities.

Hawkesbury City Council engaged WorleyParsons Services Pty Ltd (WorleyParsons) to investigate seven identified priority locations. To assist the investigations, Hawkesbury City Council provided a range of survey data for each of the identified priority locations. This data was collected in 1978, 1987 and late 2011. Additionally, soundings obtained in May 2012 at the priority locations were provided by NSW Roads and Maritime Services (RMS).

Investigations in relation to potential dredging were undertaken into the following:

- The existing environment of the project area;
- The legislative setting, including permissibility and potential approvals;
- Infill rates and sources to the project area;
- Historic bed changes in the identified locations;
- Navigation requirements to maintain existing river uses and required vessel drafts and current navigability of the identified locations;
- Potential costs associated with dredging; and
- Analysis of sediments in the project area (not yet undertaken).

The outcomes of these investigations were used to provide conclusions in relation to the need for dredging in the project area, as well as potential environmental and legislative constraints to dredging.

A Project Inception Meeting was undertaken on 2 May 2012 (refer Appendix B), which was immediately followed by a site inspection of the project area. The site inspection was undertaken by boat, with WorleyParsons personnel accompanied by Hawkesbury City Council staff.

This Summary Report presents the outcomes of desktop investigations into the existing navigability of the Hawkesbury River at the identified locations and provides conclusions on the need (or otherwise) for dredging at these locations. The need for field work to establish sediment quality in the project area will be discussed with Hawkesbury City Council in light of the findings of the desktop investigations. No community consultation has been undertaken as part of WorleyParsons' scope of work for this report.

2 EXISTING ENVIRONMENT

The Hawkesbury River within the project area stretches around 32km from "The Breakaway", upstream of the Windsor Bridge, to the Sackville Ferry river crossing. Apart from a small section of river just north of the Windsor Bridge and potentially an area around the Sackville Ferry, it is understood that the project area has not been dredged previously.

A high level of residential development occurs along the river bank within the project area, along with several caravan parks. Most of these residential and commercial developments have direct access to the river, with numerous boat ramps and pedestrian access ways present. Public boat ramps and jetties are also present, with a new wharf currently under construction adjacent to the Windsor Bridge. Agricultural land uses are also present in the project area, with livestock including horses and cattle, having direct access to the river in some areas.

The area is frequently used for recreational boating, including for water-skiing, wake-boarding and fishing. Water-skiing competitions are also held on the river within the project area. The river provides thoroughfare for vessels travelling to and from destinations further upstream.

Some areas of the river retain significant natural values, in particular around Sackville Gorge. The river is an important natural feature of the municipality and highly regarded for its aesthetics and role in the local ecosystem.

Two key river crossings occur in the project area, the Windsor Bridge in the south and the Sackville Ferry in the north. The Sackville Ferry is an important public transport link across the river. Ferry services at this general location are thought to have been in operation since the late 1800s.

Sediment quality investigations undertaken downstream of the project area in the lower Hawkesbury-Nepean River (Matthai et al., 2009) suggested an impact from booster biocides used in antifoulants on sediments in areas of high boating activity. Regionally, only few heavy metals and no organic contaminants were shown to exceed ANZECC/ARMCANZ sediment quality guideline values in sediments of the lower Hawkesbury-Nepean River. However, sediments near marinas and riverside settlements in upper Berowra and Cowan Creeks contained elevated concentrations of TBT (Matthai et al., 2009).

Acid sulphate soils (ASS) planning maps for the Hawkesbury River show the whole of the project area is mapped as Class 1 ASS. Class 1 areas are those with the highest probability of ASS being present, any works on lands of this class are considered to present an environmental risk (Ahern, Stone and Blunden, 1998).

The Natural Resource Biodiversity Maps that accompany the Draft Hawkesbury LEP 2011 show that the Hawkesbury River in the project area is mapped as providing 'Connectivity Between Significant Vegetation', while the majority of adjacent areas support 'Significant Vegetation'.

A search of the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife for species listed as threatened under the NSW *Threatened Species Conservation Act 1995* showed 593 records

of 49 different threatened species occurring in the project area. These threatened species included two frogs, 28 birds, 11 mammals and nine plant species (refer Appendix C).

One threatened fish species listed under the NSW *Fisheries Management Act 1994* has been previously recorded in the Hawkesbury LGA, as recorded on the Department of Primary Industries (DPI) Fisheries record viewer. A number of records of the endangered Macquarie perch (*Macquaria australasica*) occur in the Hawkesbury LGA, although no records of this species occur in the project area. No threatened fish species have been recorded from NSW Industry and Investment research surveys occur in the Hills Shire LGA.

A search of the Protected Matters Search Tool on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) web page showed that a number of threatened and migratory species, threatened ecological communities may occur in the project area (refer Appendix D). Additionally, two Nationally Important Wetlands, Pitt Town Lagoon, south of the Pitt Town Bottoms location and Longneck Lagoon, south of the Cattai Creek location and one National Heritage Place, First Hawkesbury Farms, are known to occur in the project area.

The Protected Matters Search identified 39 threatened species, listed under the EPBC Act, that may occur in the project area. These species incorporated six birds, three fish, four frogs, one snake, seven mammals and 18 plant species. Additionally, 14 migratory birds were also listed in the search results. A number of invasive plant species, including some aquatic species may also occur in the area.

Three threatened ecological communities, listed under the EPBC Act, may occur in the project area, as follows:

- Cumberland Plain Shale Woodlands and Shale- Gravel Transition Forest (Critically Endangered Ecological Community);
- Shale/Sandstone Transition Forest (Endangered Ecological Community); and
- Turpentine-Ironbark Forest in the Sydney Basin Bioregion (Critically Endangered Ecological Community).

A search of the OEH Aboriginal Heritage Information Management System (AHIMS) showed that 121 Aboriginal sites are recorded in or near the project area (refer Appendix D). No declared Aboriginal places were shown to occur in the project area.

Numerous heritage items occur adjacent to the river in both the Hawkesbury and Hills Shire LGAs. These items are identified in the existing and draft LEPs for these LGAs, as well in the Hawkesbury-Nepean River SREP and on the State Heritage Register.

A site inspection of the river within the project area showed that much of the fringing vegetation along the river has been cleared due to past and existing land uses, including residential, commercial and agricultural uses. Some areas of dense native bushland do however remain adjacent to the river in the project area. A high level of weed invasion, including by lantana and caster oil plant, is present along the river bank in some areas.

Bank erosion appears to be occurring in much of the project area, with bank stabilisation structures of varying quality and type present in many of these areas. At the time of the site inspection, the river appeared highly turbid and light attenuation through the water appeared to be limited. Some aquatic vegetation was present along the edges of the river, although marine vegetation including seagrasses and mangroves were not observed during the site inspection and are not expected to occur in the project area (seagrasses only occur in the Hawkesbury River downstream of Berowra Creek).

Photographs taken during the site visit are provided at Appendix F.

3 LEGISLATIVE SETTING

If dredging is to be undertaken within the project area, a range of legislation requires consideration. In the following sections, potentially relevant legislation is discussed in relation to dredging in the project area.

If dredging is proposed to be undertaken, relevant legislation should be reviewed in light of the specific project details including the location, volume and capital investment value and to ensure the provisions of current legislation are adhered to.

As the project area has not been dredged previously, any dredging undertaken for the purposes of improving navigation would comprises ‘capital dredging’, rather than ‘maintenance dredging’.

3.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the system of environmental planning and assessment in NSW. Part 4 of the EP&A Act sets out the development assessment requirements for those developments that require consent. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by or on behalf of public authorities that are permissible without development consent.

Part 4 generally requires the preparation of a Statement of Environmental Effects (SEE) or an Environmental Impact Statement (EIS), depending on the nature, location and capital investment value of the proposed development. Part 4 also specifies ‘integrated development’, where in order for the development to be carried out, one or more specified approvals is required in addition to development consent , including approvals required under the *Fisheries Management Act 1994*.

Depending on the location of any proposed dredging, both Hawkesbury City Council and The Hills Shire Council may be the consent authorities for the work if it were to be undertaken under Part 4. Consideration of the requirements of Schedule 4A of the EP&A Act would also be relevant to establish if the Joint Regional Planning Panel (JRPP) may be authorised to exercise consent authority functions of councils.

Under Part 5 of the EP&A Act, the Minister or public authority which is responsible for deciding whether to approve or proceed with an activity (called a "determining authority") must examine and take into account to the fullest extent possible all matters which are likely to affect the environment if the activity goes ahead (s.111 EP&A Act).

In order to achieve the requirements of Section 111 EP&A Act, a Review of Environmental Factors (REF) is generally prepared. The purpose of a REF is to describe the proposal, to document the likely impacts of the proposal on the environment and to detail protective measures to be implemented to minimise environmental impacts.

Clause 228 of the Environmental Planning and Assessment Regulation 2000 sets out the factors which must be taken into account concerning the impact of an activity on the environment.

The REF assists the determining authority's determination of whether the activity is likely to have a significant effect on the environment, threatened species, populations or ecological communities or their habitats, in which case an environmental impact statement (EIS) and/or species impact statement (SIS) would need to be prepared and considered before approval may be granted (s.112 EP&A Act). A REF, EIS or SIS must be determined prior to the carrying out of the activity.

Hawkesbury City Council would be the proponent if dredging were to be undertaken under the provisions of Part 5. Hawkesbury City Council and The Hills Shire Council would be expected to be the determining authorities under Part 5 (if works were proposed in both LGAs).

3.2 State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State. The Infrastructure SEPP permits public authorities, including Councils, to undertake certain activities without consent.

Provisions in relation to dredging are included in the Infrastructure SEPP. Clause 68(2) provides that development for the purposes of '*navigation and emergency response facilities*' may be carried out by or on behalf of a public authority without consent on any land or on unzoned land. 'Navigation and emergency response facilities' means facilities for:

> *(a) water traffic control, safe navigation and other safety purposes (such as beacons, navigation towers, lighthouses, buoys, marine markers, pilot stations, breakwaters or training walls), and*
>
> *(b) emergency response, including rescue stations and emergency communication facilities.*

It is considered that any dredging undertaken for the purposes of improved navigation in the project area (if required) **would not** fit within this definition.

Additionally, Clause 129 provides that development for '*waterway or foreshore management activities*' may be undertaken by or on behalf of a public authority without consent on any land. The definition of 'waterway or foreshore management activities' means:

> *(a) riparian corridor and bank management, including erosion control, bank stabilisation, resnagging, weed management, revegetation and the creation of foreshore access ways, and*
>
> *(b) instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows or tidal flows for ecological purposes, and*
>
> *(c) coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways, and*
>
> *(d) coastal protection works, and*
>
> *(e) salt interception schemes to improve water quality in surface freshwater systems, and*
>
> *(f) installation or upgrade of waterway gauging stations for water accounting purposes.*

It is considered that any dredging undertaken for the purposes of improved navigation in the project area (if required) **would not** fit within this definition.

Clause 69(3) of the Infrastructure SEPP, states:

> *Development for the purpose of dredging (other than dredging referred to in clause 68) may be carried out by any person with consent on any land.*

As such, dredging to improve navigation in the project area (if required) would require consent under the provisions of Clause 69(3) of the Infrastructure SEPP. The dredging would therefore be subject to the environmental assessment and approval requirements of Part 4 of the EP&A Act (refer Section 3.1).

For reference, dredging referred to in Clause 68 is limited to:

> *(1) Development for the purpose of port facilities may be carried out:*
>
> *(a) by or on behalf of a Port Corporation or the Maritime Authority of NSW without consent on land in a prescribed zone or on any other land, providing the development is directly related to an existing port facility, and*
>
> *(b) by or on behalf of any other public authority without consent on land in a prescribed zone.*
>
> *(2) Development for any of the following purposes may be carried out by or on behalf of a public authority without consent on any land or on unzoned land:*
>
> *(a) navigation and emergency response facilities,*
>
> *(b) environmental management works associated with a port, wharf or boating facility.*
>
> *(3) Subdivision of land in the area of a port managed by a Port Corporation, being subdivision that is required to facilitate operations at the port, may be carried out by a Port Corporation without consent.*
>
> *(4) Development for the purpose of wharf or boating facilities may be carried out by or on behalf of a public authority without consent on any land. However, such development may be carried out on land reserved under the National Parks and Wildlife Act 1974 only if the development is authorised by or under that Act.*
>
> *(4AA) To avoid doubt, subclause (4) does not permit the subdivision of any land.*
>
> *(4A) Development for the purposes of associated public transport facilities for a public ferry wharf may be carried out by or on behalf of a public authority without consent on any land. However, such development may be carried out on land reserved under the National Parks and Wildlife Act 1974 only if the development is authorised by or under that Act.*
>
> *(5) In this clause, a reference to development for the purpose of port facilities, navigation facilities, wharf or boating facilities or associated public transport facilities for a public ferry*

wharf includes a reference to the operation of such a facility and to development for any of the following purposes if the development is in connection with such facilities:

(a) construction works (including dredging and land reclamation, if it is required for the construction of facilities),

(b) routine maintenance works (including dredging, or bed profile levelling, of existing navigation channels if it is for safety reasons or in connection with existing facilities),

(c) environmental management works,

(d) alteration, demolition or relocation of a local heritage item,

(e) alteration or relocation of a State heritage item.

3.3 Sydney Regional Environmental Plan No 20 - Hawkesbury-Nepean River (No 2 - 1997)

The deemed State Environmental Planning Policy Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997) (the Hawkesbury-Nepean River SREP) applies to a number of LGAs including the Hawkesbury and Baulkham Hills LGAs.

The aim of the Hawkesbury-Nepean River SREP is to:

'protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context'

The Hawkesbury-Nepean River SREP includes planning considerations to be taken into account, including by a consent authority when determining development consent and by a public authority proposing to carry out development which does not require development consent.

These considerations include strategies in relation to environmentally sensitive areas in the Hawkesbury-Nepean catchment. The river itself is listed as an environmentally sensitive area under the Hawkesbury-Nepean River SREP (Clause 6(2)).

Clause 11(5) provides development controls for extractive industries. Under the Hawkesbury-Nepean River SREP, extractive industry means:

(a) the winning or removal of extractive material from land and any ancillary or incidental land use, or

(b) an industry or undertaking, not being a mine, which depends for its operations on the winning of extractive material from the land on which it is carried on.

Extractive industries are prohibited downstream of the Wallacia Bridge in the Hawkesbury-Nepean River, except as provided in Schedule 2 to the Hawkesbury-Nepean River SREP.

Clause 11(6) of the Hawkesbury-Nepean River SREP provides development controls, including the requirement for consent, for extractive industries comprising maintenance dredging and extractive operations. Such extractive industries are defined as:

> *(a) Dredging operations to ensure that the river is navigable from Broken Bay to Windsor Bridge, if those operations do not create a channel that did not previously exist, or*
>
> *(b) Dredging operations carried out in the river downstream of the Wallacia Bridge as a consequence of, and ancillary to, works for flood mitigation, bank stabilisation, the construction of bridges or other instream structures (such as marinas) or the withdrawal of water (whether or not the withdrawal is licensed), where extraction is necessary to carry out the works.*

Consent is required under the provisions of Clause 11(7) for the filling of land, including through disposal of spoil from dredging, where filling exceeds 1 metre in depth, or an area of 100 square metres.

3.4 Sydney Regional Environmental Plan No 9 - Extractive Industry (No 2 - 1995)

The deemed State Environmental Planning Policy Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995) (the Extractive Industry SREP) aims to facilitate the development of extractive industries while ensuring consideration of surrounding development and environmental issues. The Extractive Industry SREP also aims to prohibit the development of extractive industries in environmentally sensitive areas, including the Hawkesbury and Nepean Rivers.

The Extractive Industry SREP provides that extractive industry is permissible with consent of the council in certain areas, including the following on the Hawkesbury River, as prescribed in Schedule 1, Division 5 of the Extractive Industry SREP:

> *1 The land at Windsor covered by Licence Number 74/3, Windsor. Rocla, Hawkesbury River, Windsor.*
>
> *2 The land at Pitt Town covered by Licence Number 82/14, Windsor. Breen Holdings P/L, Hawkesbury River, Pitt Town.*

3.5 Local Environmental Plans

The project area lies within the Hawkesbury and Hills Shire Local Government Areas (LGAs). Three of the seven locations identified for investigation, Sandy Point, Cattai Creek and Bens Point, lie wholly within the Hawkesbury LGA. The boundary between the two LGAs lies in the centre of the river at the remaining locations.

The project area is unzoned under the existing Hawkesbury Local Environmental Plan 1989 (Hawkesbury LEP 1989). The Draft Hawkesbury Local Environment Plan 2011 (Draft Hawkesbury LEP 2011) shows the river upstream of the Windsor Bridge, including Ben's Point, is proposed to be

zoned W1 Natural Waterways. The remainder of the project area is proposed to be zoned W2 Recreational Waterways under the Draft Hawkesbury LEP 2011.

The Draft Hawkesbury LEP 2011 was placed on exhibition from 5 February 2010 to 12 April 2010. Council resolved to forward the Draft Hawkesbury LEP 2011 to the Department of Planning and Infrastructure for finalization and gazettal on 7 June 2011.

Part of the Sackville Ferry, Sackville Gorge, Ebenezer Church and Cattai Creek locations are currently zoned Rural 1(b) under the Baulkham Hills Local Environmental Plan 2005 (Baulkham Hills LEP 2005). The Hills Shire Council has also prepared the Draft The Hills Local Environmental Plan 2010 (Draft The Hills LEP 2010). The locations lying partly within the Hills Shire LGA are zoned W2 Recreational Waterways under the Draft The Hills LEP 2010. The Hills Shire Council at its meeting on 23 August 2011 resolved to forward the Draft The Hills LEP 2010 to the Department of Planning and Infrastructure for finalisation. The Hills Shire Council anticipates that the Draft The Hills LEP 2010 will be finalised early in 2012.

The current and proposed zoning for each of the identified locations is summarised in Table 3-1.

Table 3-1: Zoning of investigation locations within the project area

	Hawkesbury LGA Zoning		Hills Shire LGA Zoning	
Location	**Hawkesbury LEP 1989**	**Draft Hawkesbury LEP 2011**	**Baulkham Hills LEP 2005**	**Draft The Hills LEP 2010**
Sackville Ferry	Unzoned	W2 Recreational Waterways	Rural 1(b)	W2 Recreational Waterways
Sackville Gorge	Unzoned	W2 Recreational Waterways	Rural 1(b)	W2 Recreational Waterways
Ebenezer Church	Unzoned	W2 Recreational Waterways	Rural 1(b)	W2 Recreational Waterways
Cattai Creek	Unzoned	W2 Recreational Waterways	Rural 1(b)	W2 Recreational Waterways
Sandy Point	Unzoned	W2 Recreational Waterways	N/A	N/A
Pitt Town Bottoms	Unzoned	W2 Recreational Waterways	N/A	N/A
Bens Point	Unzoned	W1 Natural Waterways	N/A	N/A

3.6 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides a legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places. Matters of national environmental significance under the EPBC Act include:

- Listed threatened species and communities;
- Listed migratory species;
- Ramsar wetlands of international importance;
- Commonwealth marine environment;
- World heritage properties;
- National heritage places;
- The Great Barrier Reef Marine Park; and
- Nuclear actions.

Under the provisions of the EPBC Act, an action that will have, or is likely to have, a significant impact on a matter of national environmental significance requires approval from the Minister for Sustainability, Environment, Water, Population and Communities.

As described in Section 2, a number of matters of national environmental significance occur in the project area, including threatened and migratory species, threatened ecological communities, two Nationally Important Wetlands and a National Heritage Place. An assessment of the likely impacts on these matters would be required to determine if dredging was likely to cause a significant impact and thus require referral under the EPBC Act.

3.7 Fisheries Management Act 1994

Part 7 of the *Fisheries Management Act 1994* requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation.

Section 200 of the Fisheries Management Act 1994 states:

> *'A local government authority must not carry out dredging or reclamation work except under the authority of a permit issued by the Minister.'*

As such, a permit would be required under the provisions of the *Fisheries Management Act 1994* if Hawkesbury City Council is to carry out dredging work if the work were to be approved under Part 5 of the EP&A Act. If the work were to be approved under Part 4 of the EP&A Act, the work would comprise integrated development (refer Section 3.1).

Section 205 of the Fisheries Management Act 1994 states:

> *'A person must not harm any such marine vegetation in a protected area, except under the authority of a permit issued by the Minister under this Part.'*

Although not expected to occur in the project area, if any marine vegetation, such as mangroves or seagrasses, was expected to be impacted through the dredging processes, a permit under Section 205 would also be required.

3.8 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* prescribes those works that constitute 'scheduled activities' and as such require an Environmental Protection Licence.

Schedule 1 (Section 19) of the Act includes water-based extractive activity as a scheduled activity. 'Water-based extractive activity' means:

> *the extraction of extractive materials, either for sale or re-use, by means of dredging or other such water-based methods*.

Water-based extractive activity involving the extraction of more than 30,000m^3 per year of extractive materials is declared in Schedule 1 as a premises-based scheduled activity. Should dredging involve extraction of more than 30,000m^3 per year of extractive materials, dredging work would be declared a scheduled activity pursuant to Schedule 1 Part 1.

Section 49(2) of the Act states:

> *'A person who carries on any such scheduled activity is guilty of an offence, unless the person is, at the time that activity is carried on, the holder of a licence that authorises that activity to be carried on.'*

As such, an Environmental Protection Licence would be required under the provisions of the *Protection of the Environment Operations Act 1997* to undertake dredging work, only if dredging of 30,000m^3 or more per year is required. However, an Environmental Protection Licence may be obtained for smaller dredging projects in order to protect the principal from prosecution relating to the discharge of pollutants to water.

3.9 Crown Lands Act 1989

All reserved Crown land is subject to the general land management objectives and provisions of the *Crown Lands Act 1989*, including the reserve management provisions of Part 5. The land management provisions relating to the protection of public land in Division 5 of Part 7 of the *Crown Lands Act 1989* also apply.

The principles of Crown land management, as specified in Section 11 of the *Crown Lands Act 1989,* are that:

- Environmental protection principles be observed in relation to the management and administration of Crown land;
- The natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible;
- Public use and enjoyment of appropriate Crown land be encouraged;
- Where appropriate, multiple use of Crown land be encouraged;
- Where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity; and
- Crown land be occupied, used, sold, leased, licenced or otherwise dealt with in the best interests of the State consistent with the above principles.

Licences can be issued for the use of Crown land, including for the extraction of materials such as dredging of sand and gravel from waterways (Section 49). Use of such materials for commercial purposes would also attract royalty payments on the materials removed in addition to annual rent paid on licences (Section 50).

If no existing Crown lease is in place over the river authorising Hawkesbury City Council to undertake dredging, a licence would be required for the use of the Crown land.

3.10 Water Management Act 2000

The *Water Management Act 2000* governs sustainable and integrated management of water sources across the State.

Part 3 of the *Water Management Act 2000* prescribes the approvals required for certain water uses, water management works, controlled activities and aquifer interference. A 'controlled activity approval' is required under the *Water Management Act 2000* for controlled activities undertaken in, on or under waterfront land. Section 91E of the *Water Management Act 2000* states:

> *(1) A person:*
>
> *(a) who carries out a controlled activity in, on or under waterfront land, and*
>
> *(b) who does not hold a controlled activity approval for that activity,*
>
> *is guilty of an offence.*

Division 2, Subdivision 4 of the Water Management (General) Regulation 2011 provides exemptions from the requirement for a controlled activity approval. Clause 38 states:

> *A public authority is exempt from Section 91E (1) of the Act in relation to all controlled activities that it carries out in, on or under waterfront land.*

As such, Hawkesbury City Council, a public authority, is exempt from the requirement to obtain a controlled activity approval and approval under the *Water Management Act 2000* is not required.

4 SEDIMENT INFILL RATES

Sediment infilling is a complex process, dependent not only on local hydrodynamics, but also the characteristics of local sediments. At this stage, sediment sampling in the project area has not been carried out as part of this project, nor are velocity measurements available for this section of the Hawkesbury River. Both of these represent data that is typically required to estimate the erosion or sedimentation potential predictions, and hence sediment infill rates.

Accordingly, the following assessment of sediment infill rates is based on a review of available literature and studies for the Hawkesbury River. It attempts to corroborate the observed trend of net scour between the 1978 bed survey and the 2011 bed survey profiles (refer Section 5). It was attempted to consult all relevant literature; however, it is recognised that the sources used may not represent an exhaustive list, particularly given the degree to which the Hawkesbury River has been studied to date.

It is also understood that further investigations are currently underway by Sydney Water to collect additional data for the Hawkesbury River related to Hawkesbury-Nepean River estuary numerical model. Data from this study may be of relevance to sediment infilling and mobility.

4.1 Erosion and Sedimentation Potential

Using the Hjulström Diagram (USBR, 2006) it is possible to identify the behaviour of sediments along a stretch of river. Although there are limitations in using this diagram, it provides a ready guide as to whether material will likely accrete or erode based on the particle size and the average channel velocity. At each key location, based on the cross-sectionally averaged velocities it can be identified whether the section would most likely be undergoing erosion or accretion or remaining constant.

Sediment types can vary greatly over the length of a river as natural sorting of the grain size occurs. For the purposes of this study, it has been assumed that the sediments can be characterised as a fine sand with a typical grain size of 0.2 mm diameter. This represents an erosive material which will be readily swept into the channel, yet is still able to settle from the flow and deposit should conditions allow. With respect to infilling along the Hawkesbury River this sediment type represents a conservative case; however it is acknowledged that sediment would be considerably more variable.

In the absence of site specific field data, a velocity at the peak of the tidal cycle in the Hawkesbury River has been assumed to be in the range 5 cm/s to 15 cm/s. based on interpretation of the Hjulström Diagram, it is expected that this section of the river would be in the “Transportation” mode (refer Figure 4-1). In this mode sediment that has become mobilised will continue to be carried by the flow. However, velocities are not sufficient to mobilise sediment that has already been deposited and settled on the river bed. During slack water, where the tide reverses, the velocity is reduced to zero or near zero and sediment would be expected to settle on the river bed. As a result, during periods of average or dry flow there may be an accumulation of sediment if suitable sediment supply is available.

During flood flows, velocities may be in the range 0.6 m/s to 2 m/s. Figure 4-1 indicates that velocities of this magnitude would be highly erosive. Such velocities would have the potential to mobilise sediments ranging from fine silts and clays to gravels. Under these conditions, any sediment which has the potential to be mobilised will likely become mobilised and flushed from the river.

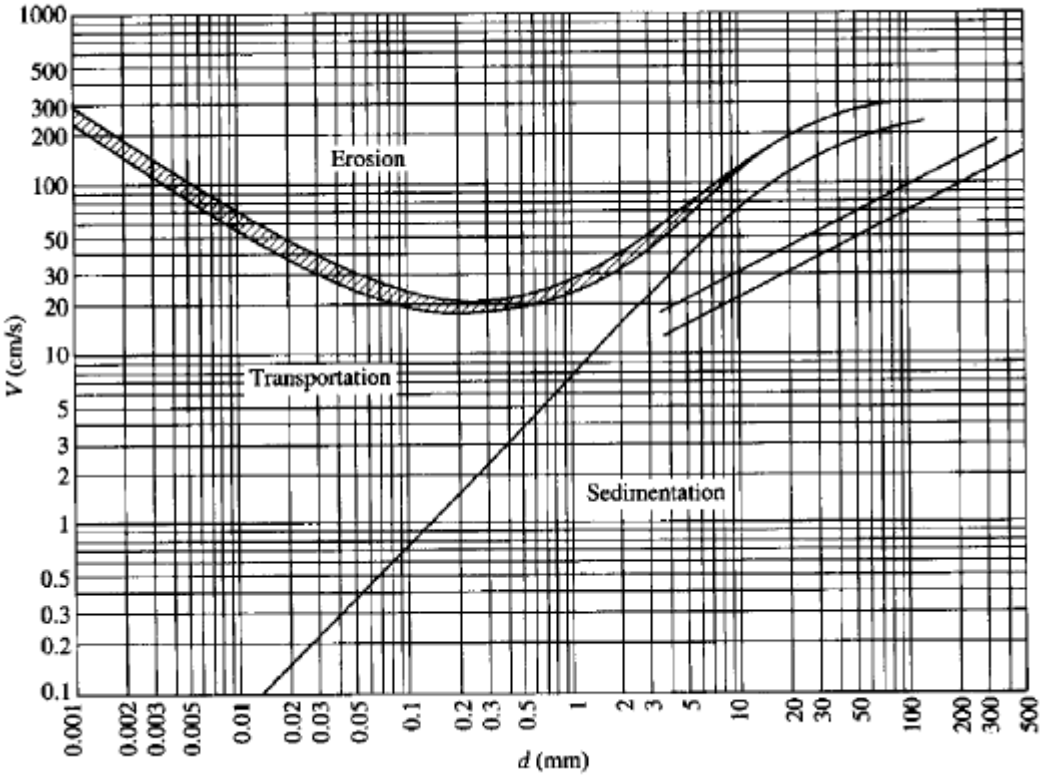

Figure 4-1: Hjulström Diagram (*USBR 2006: Erosion and Sedimentation Manual*)

4.2 Sediment Supply

Sediment supply attributes for the Hawkesbury-Nepean River are documented in the Australian Natural Resources Atlas (Australian Government, 2002). The total sediment supply to the Hawkesbury-Nepean River system is 1,125,630 tons per year. Of this, 21% is delivered to the coast. 79% of the total sediment load is therefore deposited within the system. Sediment supply for the river is listed as 0.52 tonnes per hectare of catchment per year. This compares with a typical Australia wide value of 0.5 tonnes per hectare per year. As such, the Hawkesbury River receives slightly greater sediment load relative to catchment size compared with typical Australian rivers.

Despite this, the Australian Natural Resources Atlas estimates that only 8% of the Hawkesbury-Nepean River bed length is experiencing sediment deposition. Therefore, it is expected that only limited sections are experiencing sediment deposition.

The above data is compiled on a catchment wide basis and therefore does not consider the effect of features such as the Penrith Weir, which will act to block sediment supply to downstream reaches (Healthy Rivers Commission of NSW, 1998), including the project area. Accordingly, this section of the Hawkesbury River may be supply limited, thereby limiting the potential for sediment infilling.

Local stream bank erosion is noted as a problem in the area (Healthy Rivers Commission of NSW, 1998). However, the Commission noted that it is unlikely that sediment supply due to bank erosion along the Hawkesbury River, as well as its tributaries including South Creek, Eastern Creek, Cattai Creek and the Grose River, is able to compensate for the lack of sediment supply due to sediment capture in upstream dams and weirs.

4.3 Infill and Scour

In light of the above information, it is likely that the section of the Hawkesbury River under consideration undergoes periods of accretion during low flows, while experiencing net scour due to the effect of flood flows. This is consistent with the observed bed profile surveys (refer Section 5), which show a net scour between the 1978 bed survey and the 2011 bed survey profiles.

Notwithstanding this, limited accretion is noted in some surveyed sections, which may be due to sediment supply from local stream bank erosion. In addition, secondary (helicoidal) flows are likely to move sediment from the outside to the inside of river bends, forming shoals on the inside bend from locally sourced sediment.

5 HISTORIC RIVER BED CHANGES

Over time, the course and bed profile of a river changes due to many factors including local land uses, water extraction, tidal influences and natural changes brought about by flooding events. An assessment of historic and recent data was undertaken to review the changes to the Hawkesbury River at the locations identified for investigation since the 1970s and to form an understanding of current navigability at these locations.

River bed survey data obtained from the investigation locations during the 1970s and 1980s, was compared with survey data from these locations obtained in September 2011. Information on the source, content and processing of this data is provided at Appendix G.

The locations identified for investigation and cross sections analysed at each of the identified locations are shown in Figure 5-1. Cross sections are numbered at each location, with Cross Section 1 being the most upstream cross section at each location. The cross sections produced to assess historic river bed changes at each location are provided at Appendix H.

The outcomes of the assessment of historical changes in the river bed are described in Sections 5.1 to 5.7 for each of the investigation locations.

Figure 5-1: Locations identified for investigation and cross sections analysed

5.1 Sackville Ferry

At the Sackville Ferry location, six cross sections of the river bed were available for consideration. Cross Sections 1 to 3 clearly show that the upstream area is fairly shallow and has generally maintained its profile from 1978 to 2011. Up to 2 m of sediment deposition has occurred on the right side of these sections, whilst the left banks have scoured. The river bed profile has become increasingly undulating across these sections since the 1978 survey.

Cross Sections 4 to 6 extend around the bend located downstream towards Lower Portland and Wisemans Ferry. The maximum depth along this part of the Hawkesbury River is at least 15 m at each section. Cross Section 4 indicates scour along the left bank and sediment deposition along the banks of the channel. The data at Cross Section 5 shows little change in the channel profile, except for scour on both the far left and right banks. Inspection of deeper parts of the channel indicated the sparser data collected in 1978 compared well with the higher resolution profiles of the 2011 survey.

The depths of the channel thalweg[1] were maintained from 1978 to 2011 in Cross Section 6, however the thalweg has moved transversely, approximately 25 m closer to the left bank. The data indicates that both banks of the channel had scoured significantly over the 33 years between surveys.

The data indicates that shoaling by some 1 to 2 m has occurred on the right bank at the Sackville Ferry crossing.

5.2 Sackville Gorge

Signs of scour were present in Cross Sections 1 and 2 at Sackville Gorge along both banks of both channels and along the base of Cross Section 1. The channel thalweg has moved further away from the right bank in Cross Section 2, with sediment deposition decreasing the channel thalweg depth by 4.5 m. The profile of Cross Section 3 appears to have changed very little since the 1978 survey, with minimal scouring at the channel thalweg and slight scouring of the right hand bank.

5.3 Ebenezer Church

Varying levels of scour were apparent at all cross sections at Ebenezer Church. The right bank and channel bed of Cross Section 1 have experienced approximately 1 m of scouring since 1978, whilst the banks of Cross Sections 2 and 3 have scoured on the left and shoaled on the right. Both channel thalwegs have moved transversely to the left in Cross Sections 2 and 3.

[1] The line that connects the deepest points in a river channel and, thus, the line of fastest flow along a river's course. It coincides usually with the navigable channel.

5.4 Cattai Creek

Cross Section 1 at Cattai Creek has scoured considerably since the 1978 survey. The channel has widened and its depth has increased. Both banks of Cross Section 2 have also scoured, while some sediment deposition along the bed has smoothed out the channel thalweg. Shoaling and scour are present at Cross Section 3, which has a shallow, undulating bed profile. Cross Sections 2 and 3, which are located along the river straight and upstream of the next bend respectively, generally have maintained their profiles between the 1978 and 2011 surveys.

5.5 Sandy Point

The three surveyed cross sections at Sandy Point have changed little from 1978 to 2011. There has been scour over most of the profile at Cross Section 1, in particular over the left bank. At Cross Sections 2 and 3, the left banks have scoured and the right banks have shoaled, producing a wider channel overall. At all sections, the channel thalweg has moved transversely but depth has been maintained.

5.6 Pitt Town Bottoms

Cross Section 1 at Pitt Towns Bottoms shows significant scour of up to 3.5 m over the right bank of the channel since 1978, while the location and depth of the channel thalweg has been maintained. Along the straight stretch of river that follows, Cross Sections 2 to 5 are comparatively shallow. The bed profile hasn't changed at Cross Section 2 or Cross Section 5, matching the 1988 surveyed profile closely. There has been a small amount of scour across the widths of Cross Sections 3 and 4. The left bank at Cross Section 5 has steepened due to scour.

5.7 Ben's Point

Cross Section 1 at Ben's Point is extremely shallow across its total width, with a bed level of -3 m AHD in the narrow 25 m wide channel. This cross section has slightly decreased in depth between 1987 and 2011. Cross Section 2 generally is unchanged between the data sets, with only minimal scour along both banks of the channel. Compared with its profile from 1987, there has been up to 2 m of sediment deposition in the channel at Cross Section 3, which is more than 4 m deep, with up to 2 m of scouring along both banks.

6 CURRENT NAVIGABILITY

An analysis was undertaken of the identified investigation locations within the Hawkesbury River to determine their current navigability (refer Appendix I). Navigation requirements in terms of depth and channel width were assessed and compared with the existing conditions at each of the locations.

The analysis was primarily based on survey data collected in 2011. As the Hawkesbury River was inundated in early 2012, soundings obtained by NSW Roads and Maritime Services (RMS) in May 2012 at the priority locations were used to approximate the current river bed profile (refer Appendix J). This information formed eight cross sections over the project area, one at each of the priority locations, with two at Cattai Creek (refer Figure **6-2** to Figure **6-9**).

Tidal planes from 2009 to 2010 and tide data from May 2012 (purchased from Manly Hydraulics Laboratory, refer Appendix K and Appendix L) were utilised to adjust the soundings to Australian Height Datum (AHD) for comparison with the 2011 survey data. A description of this adjustment process is provided at Appendix G.

It should be noted that the soundings were far less accurate than the 2011 survey. The soundings taken following the flood event in early 2012 could not be compared directly with the 2011 survey data as they did not show the same true location. The soundings did however assist in assessing the current navigability of the river.

6.1 Navigation Requirements

The navigation requirements for the project area were determined to comprise a minimum functional water depth of 1.8 m at mean low water spring tide (Table **6-1**). This was based on the draught of a 20 m power boat with an under keel clearance of 0.3 m, giving an acceptable bed level of -1.9 m to -2.1 m AHD and below.

Given the project area is largely used for recreational boating, including water-skiing and wake-boarding, these reference depths are considered to be conservative. Most recreational boats, in particular water-skiing and wake-boarding boats, have a much lower draught than those referenced in Table **6-1**.

Table 6-1: Navigation requirement assumptions (reference AS 3962-2001)

Element	Depth
20 m power boat draught	1.5 m
Under keel clearance	0.3 m
Minimum functional water depth	1.8 m

An ideal fairway[2] width of 100 m was assumed to be required for the project area, allowing 30 m between passing vessels and 30 m clearance to each bank (Figure **6-1**). However, in restricted areas a fairway width of 50 m was considered to be acceptable. These assumptions were confirmed with RMS (pers. comm.).

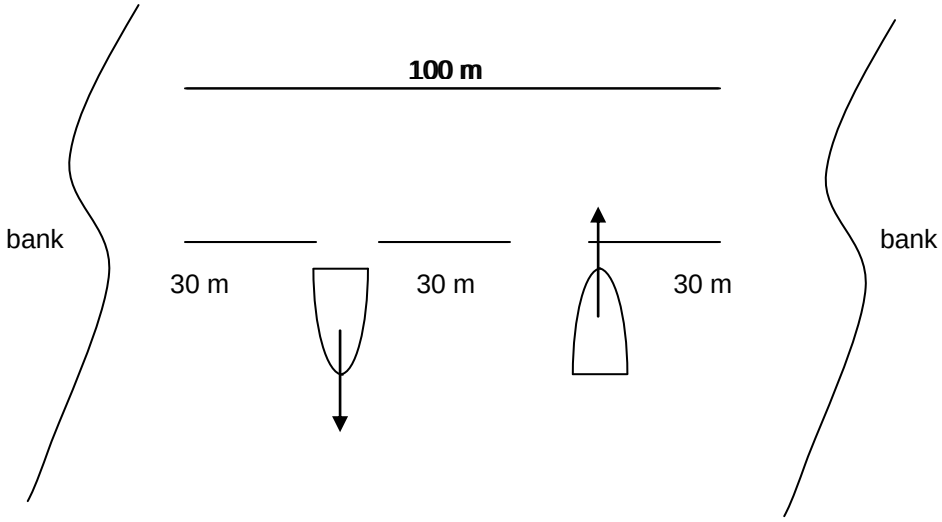

Figure 6-1: Schematic showing ideal fairway width

Given a minimum functional water depth of 1.8 m at mean low water spring tide, the tidal planes provided by Manly Hydraulics Laboratory were used to determine the maximum functional bed level at each of the priority locations (i.e. the maximum bed level at which a water depth of at least 1.8 m will present at mean low water spring tide) (Table **6-2**).

The maximum functional bed level at each location was then compared with cross sections developed from the 2011 survey data for that location to assess its navigability. The results are provided in Appendix I and area discussed in Sections 6.2 to 6.8.

[2] A navigable deep-water channel in a river.

Table 6-2: Maximum functional bed level of priority locations

Location	Mean low water spring tide	Tide reference station (station number)	Reference minimum functional water depth	Location maximum functional bed level
Sackville Ferry	-0.3 m AHD	Sackville (212406)	1.8 m	-2.1 m AHD
Sackville Gorge	-0.2 m AHD	Ebenezer (212427)	1.8 m	-2.0 m AHD
Ebenezer Church	-0.2 m AHD	Ebenezer (212427)	1.8 m	-2.0 m AHD
Cattai Creek	-0.2 m AHD	Ebenezer (212427)	1.8 m	-2.0 m AHD
Sandy Point	-0.2 m AHD	Ebenezer (212427)	1.8 m	-2.0 m AHD
Pitt Town Bottoms	-0.2 m AHD	Ebenezer (212427)	1.8 m	-2.0 m AHD
Ben's Point	-0.1 m AHD	Windsor (212426)	1.8 m	-1.9 m AHD

6.2 Sackville Ferry

The area at Sackville Ferry identified for investigation is located on a bend with six cross sections available for consideration. All cross sections show that the bed level is below or equal to the location maximum functional bed level of -2.1 m AHD (Table **6-2**).

Cross Sections 1 to 3 show that the upstream area is shallow. The deepest areas along this reach occur at Cross Section 3, which has a maximum bed level of -4.1 m AHD. The channel width here is approximately 90 m. Cross Sections 1 and 2 have irregular bed profiles with shallow undulating areas slightly deeper than the maximum functional bed level of -2.1 m AHD, maintaining sufficient channel width.

Cross Sections 4 to 6 move around the bend, downstream towards Lower Portland and Wisemans Ferry. This part of the Hawkesbury River is very deep, with each cross section showing a bed level of at least -15 m AHD. On mid tide, bed levels below -5 m AHD occur for approximately 80 m across the river.

A summary of the maximum depths and channel widths at Sackville Ferry is provided in Table **6-3**.

Table 6-3: Maximum depths and channel widths at Sackville Ferry

Cross Section	Maximum depth on AHD	Channel width at -2.1 m AHD	Comment
1	3.6 m	120 m	Continuous channel with depths greater than 2.1 m (at mean low water springs), made up of two shallow sub-channels up to 3.5 m deep, separated by a rise in the bed profile that does not rise above the maximum functional bed level.
2	3.2 m	173 m	Entire cross section has an undulating bed profile.
3	4.1 m	89 m	Navigable channel on right hand side of cross section.
4	16.4 m	100 m	Navigable channel on left hand side of cross section.
5	15.2 m	123 m	Navigable channel spans width of cross section, thalweg towards left bank.
6	18.4 m	135 m	Navigable channel spans width of cross section, thalweg towards left bank.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel width at Sackville Ferry may have been reduced to around 60 m. However this remains within the assumed acceptable limit (Figure **6-2**).

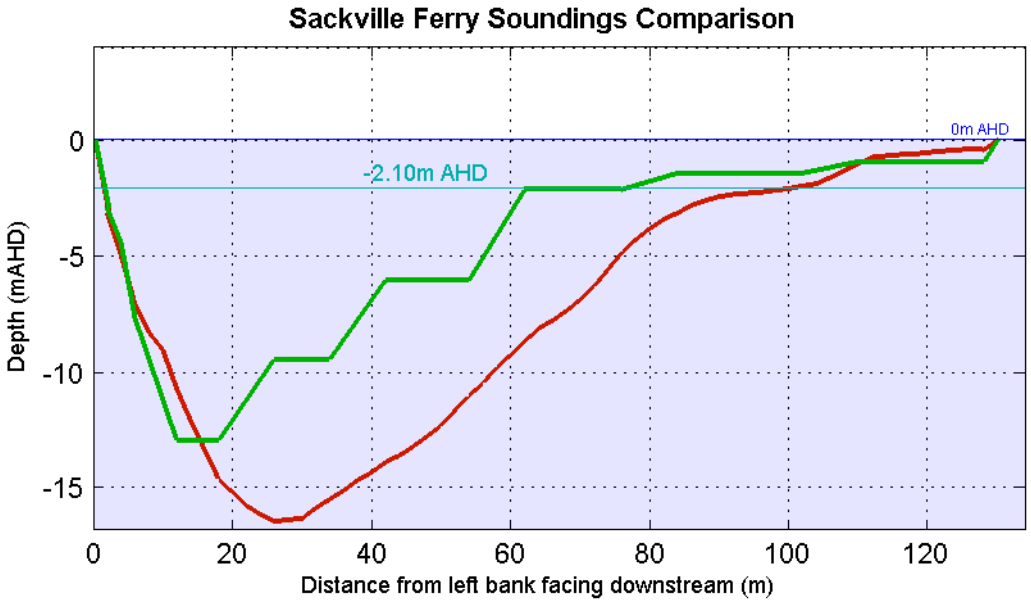

Figure 6-2: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Sackville Ferry

6.3 Sackville Gorge

There are three cross sections at Sackville Gorge, one at the 90° bend and one either side of the bend. Cross Section 1, upstream of the bend, shows a wide bed profile where depths greater than -6 mAHD extend across a width of 138 m. Cross Section 2, on the bend, shows a significant deep area towards the right bank on the wide side of the bend. By Cross Section 3, the river has shallowed out again with a maximum depth of -6 mAHD at the left bank and a navigable channel almost 130 m wide.

A summary of the maximum depths and channel widths at Sackville Gorge is provided in Table **6-4**.

Table 6-4: Maximum depths and channel widths at Sackville Gorge

Cross Section	Maximum depth on AHD	Channel width at -2.0 m AHD	Comment
1	6.4 m	138 m	Navigable channel spans width of cross section.
2	14.3 m	77 m	Wide channel on right hand side of cross section.
3	6.0 m	126 m	Wide channel on right hand side of cross section.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel width at Sackville Gorge may have been reduced following the flood event in early 2012 to around 50 m However, this remains at the assumed acceptable limit (Figure **6-3**).

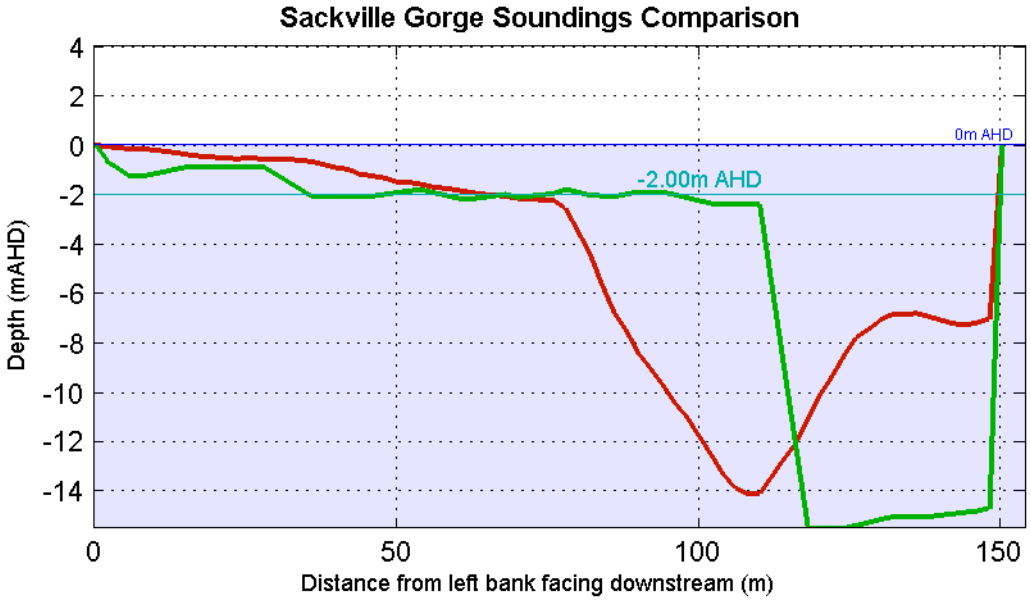

Figure 6-3: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Sackville Gorge

6.4 Ebenezer Church

The bend in the priority area at Ebenezer Church is approximately 110°. There are three cross sections here, one at the bend and one either side of the bend. Similar to Sackville Gorge, Cross Section 1 upstream of the bend shows a wide bed profile where depths up to -4.6 m on AHD extend across a width of 129 m. Cross Section 2, on the bend, shows a significant deep area, greater than -21 m AHD, towards the left bank on the wide side of the bend. By Cross Section 3, the river has shallowed out again with a maximum depth of -5 m on AHD, which plateaus across the profile for approximately 60 m.

A summary of the maximum depths and channel widths at Ebenezer Church is provided in Table **6-5**.

Table 6-5: Maximum depths and channel widths at Ebenezer Church

Cross Section	Maximum depth on AHD	Channel width at -2.0 m AHD	Comment
1	4.6 m	129 m	Wide channel spanning most of section.
2	21.7 m	104 m	Wide channel, deep thalweg towards left bank.
3	5.6 m	101 m	Wide channel on left hand side of section.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel at Ebenezer Church may have been reduced following the flood event in early 2012 to around 90 m in width, however this remains within the assumed acceptable limit (Figure **6-4**).

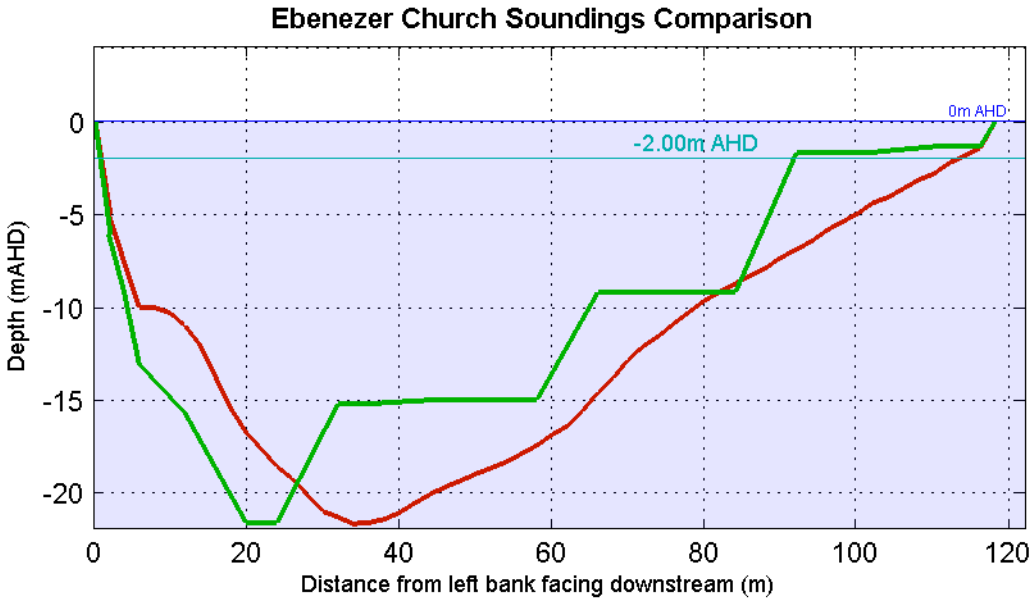

Figure 6-4: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Ebenezer Church

6.5 Cattai Creek

As the straight reach at Cattai Creek is bounded by two river bends, the maximum depth of -20 mAHD at Cross Section 1 is not unexpected. Cross Section 2 has a depth up to -8 mAHD for 108 m of its 140 m total width. Cross Section 3 however, is considerably shallower, with a depth of up to -3.3 m AHD and a channel width of 65 m where bed levels are -2.0 m AHD or below.

A summary of the maximum depths and channel widths at Cattai Creek is provided in Table **6-6**.

Table 6-6: Maximum depths and channel widths at Cattai Creek

Cross Section	Maximum depth on AHD	Channel width at -2.0 m AHD	Comment
1	20 m	94 m	Wide channel, deep thalweg towards right bank.
2	8 m	104 m	Wide channel spanning width of cross section.
3	3.3 m	65 m	Narrow channel at left bank.

Two soundings were available at Cattai Creek for review against the 2011 survey data. The first of these soundings shows that the bed depth may have increased, creating a deeper, wider channel (Figure **6-5**). The 2011 data therefore represents the worst case scenario for this section, which remains navigable. The second sounding at Cattai Creek shows that bed depth may have reduced at this location. Despite this, a navigable channel of around 95 m in width remains (Figure **6-6**).

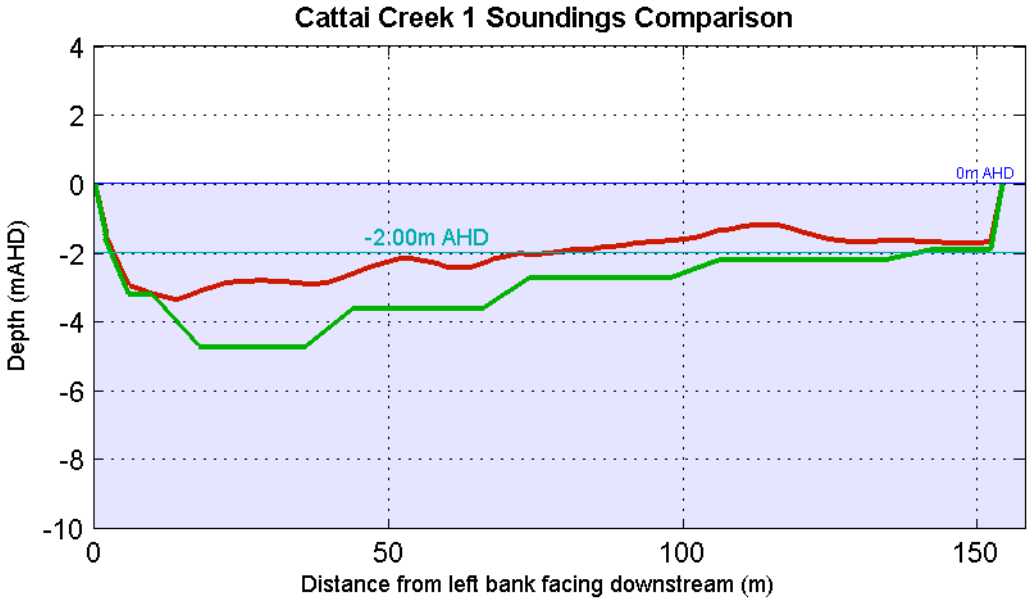

Figure 6-5: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Cattai Creek

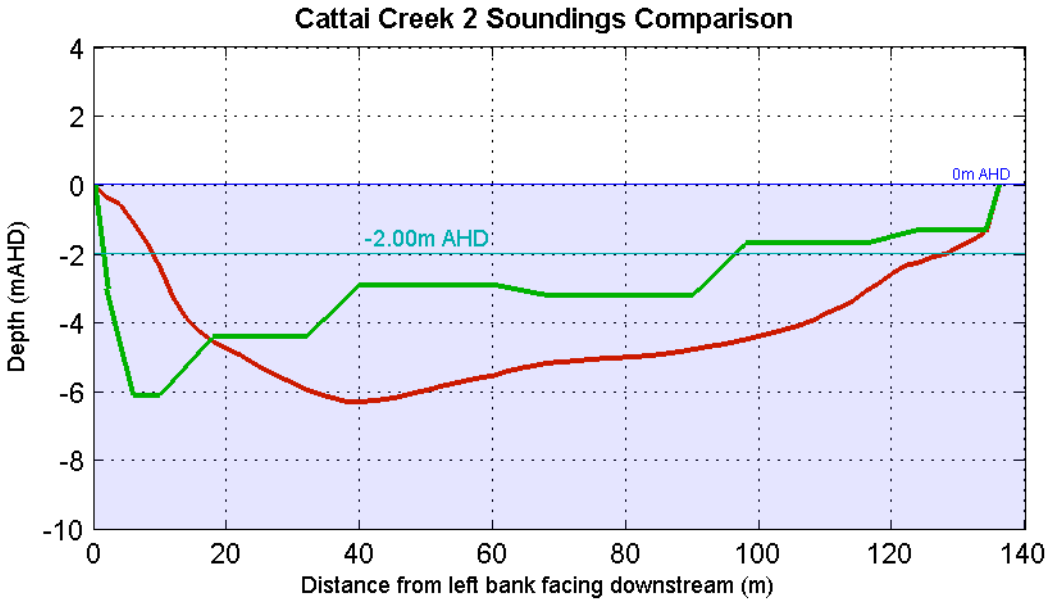

Figure 6-6: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Cattai Creek

6.6 Sandy Point

Cross Section 1 at Sandy Point, just upstream of the sharp bend is almost -10 m AHD at its deepest. On mid tide, the depth of this cross section is greater than -4 m AHD over a width of at least 80 m.

Cross Section 2 has a depth greater than -4 m AHD at mid tide across a width of 60 m. The river shallows by Cross Section 3, downstream of the "u" bend, with a navigable thalweg depth of -4 m AHD at mid tide for approximately 60 m width towards the right bank.

A summary of the maximum depths and channel widths at Sandy Point is provided in **Table 6-7**.

Table 6-7: Maximum depths and channel widths at Sandy Point

Cross Section	Maximum depth on AHD	Channel width at -2.0 m AHD	Comment
1	9.8 m	73 m	Wide channel, thalweg towards left bank.
2	8.8 m	62 m	Wide channel, thalweg in the centre of the cross section.
3	4.2 m	104 m	Wide channel.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel width at Sandy Point may have been reduced following the flood event in late February to around 75 m. However, this remains within the assumed acceptable limit (Figure **6-7**).

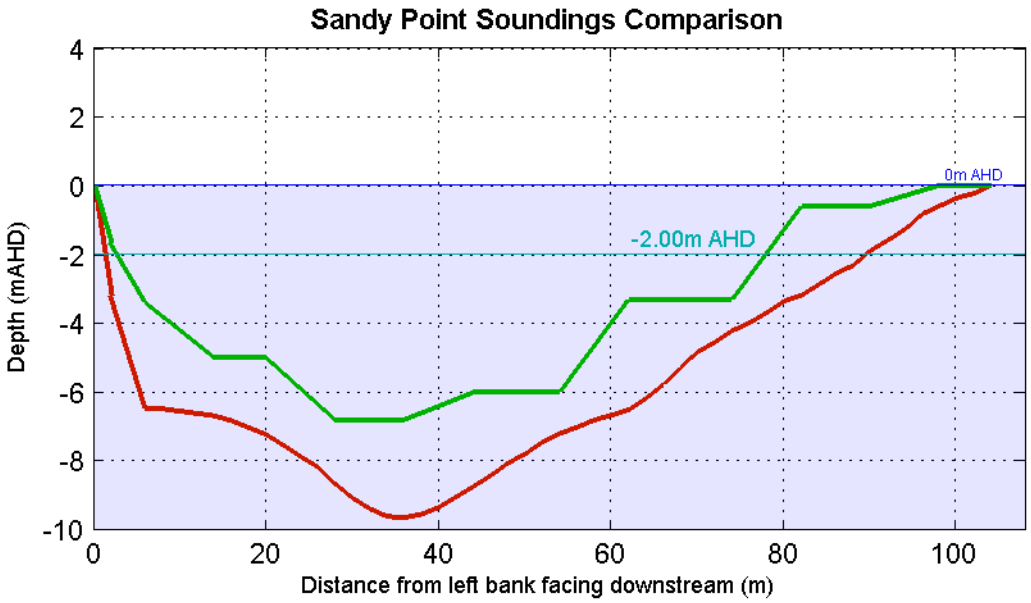

Figure 6-7: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Sandy Point

6.7 Pitt Town Bottoms

Pitt Town Bottoms is a straight reach of the Hawkesbury River, almost 2 km in length. Five cross sections were available for analysis in this location. At the upstream end, the river comes out of a 120° bend, with a thalweg of -10 mAHD at Cross Section 1.

The river is a consistent width of 110 m wide from Cross Sections 2 to 5. The Pitt Town Bottoms location is relatively shallow, but navigable, with depths of -3.3 mAHD to -4.6m AHD over channel widths of 95 m to 110 m.

A summary of the maximum depths and channel widths at Pitt Town Bottoms is provided in Table **6-8**.

Table 6-8: Maximum depths and channel widths at Pitt Town Bottoms

Cross Section	Maximum depth on AHD	Channel width at -2.0 m AHD	Comment
1	10.1 m	97 m	Wide channel, deep thalweg towards left bank.
2	3.8 m	97 m	Wide channel spanning width of section.
3	4.6 m	110 m	Wide channel, thalweg towards left bank.
4	3.4 m	104 m	Wide channel, thalweg towards right bank.
5	3.3 m	98 m	Wide, shallow channel, thalweg towards left bank.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel width at Pitt Town Bottoms may have been reduced following the flood event in late February (Figure **6-8**). A navigable channel of around 110 m remains.

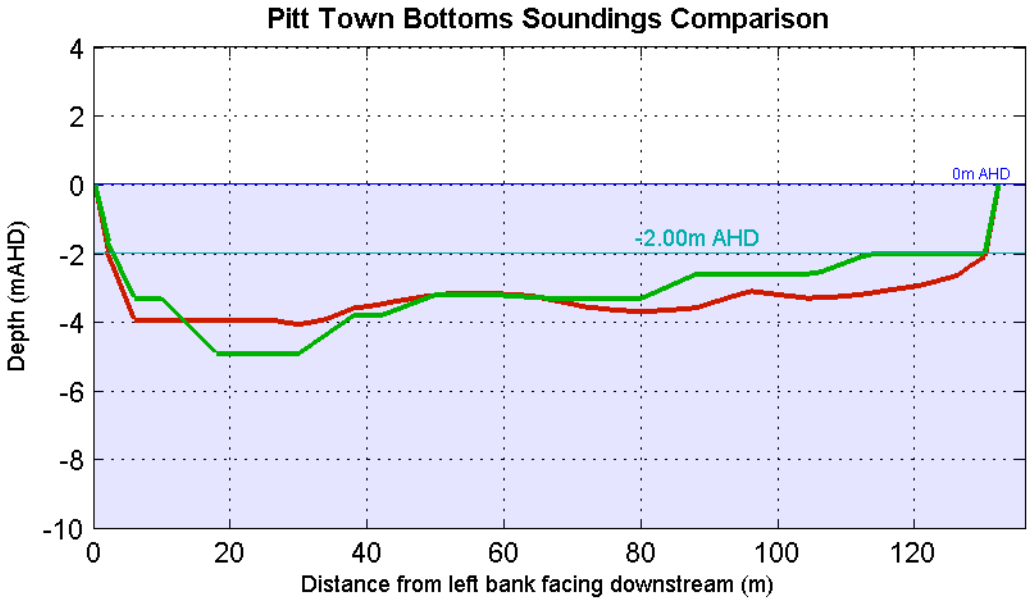

Figure 6-8: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Pitt Town Bottoms

6.8 Ben's Point

The three cross sections at the Ben's Point priority location show the river moving from a shallow reach upstream of the bend, to a deeper channel through and downstream of the bend, as shown in Cross Sections 2 and 3, respectively.

Cross Section 1 is shallow, but navigable in depth. However, the channel here is narrow, being only 25 m wide. Cross Sections 2 and 3 have a maximum depth of -6.4 m on AHD and -4.4 m on AHD respectively, both with sufficient channel width.

A summary of the maximum depths and channel widths at Ben's Point is provided in Table **6-9**.

Table 6-9: Maximum depths and channel widths at Ben's Point

Cross Section	Maximum depth on AHD	Channel width at -1.9 m AHD	Comment
1	3.0 m	25 m	Narrow, shallow channel at right bank.
2	6.4 m	47 m	Channel at right hand side of cross section.
3	4.4 m	47 m	Channel towards right hand side of cross section.

Review of the 2011 survey data against the 2012 RMS soundings show that the channel width at Ben's Point may have been increased following the flood event in late February to around 65 m. However, this remains within the assumed acceptable limit (Figure **6-9**). As the bed depth had increased, the 2011 data represents worst case scenario.

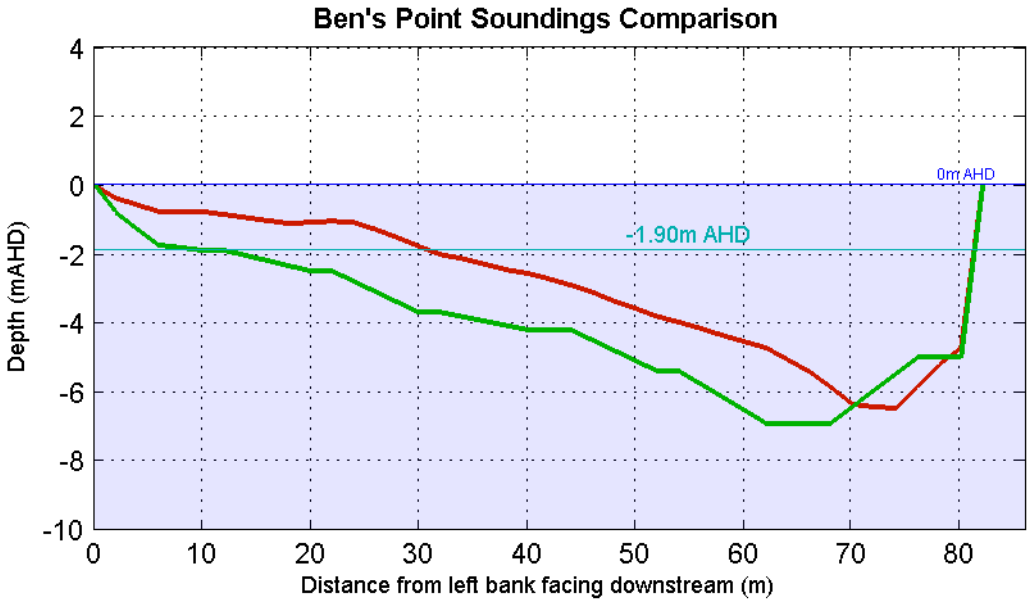

Figure 6-9: Review of 2011 survey data (red line) against 2012 RMS soundings (green line) at Ben's Point

6.9 Alternative Minimum Functional Water Depth

Although the navigation requirements provided in Section 6.1 are considered to be appropriate for the Hawkesbury River within the project area, Hawkesbury City Council has suggested that there would be merit in investigating the potential for provision of a minimum functional water depth of 3.0 m at mean low water spring tide (letter from Hawkesbury City Council dated 2 August 2012). This alternative minimum functional water depth was flagged as potentially enabling navigation for larger recreational and commercial vessels in the upper reaches of the Hawkesbury River system.

The maximum functional bed level at each of the priority locations for the alternative minimum functional water depth was calculated by adding 1.2 m to the maximum functional bed level described in Table **6-2**.

A summary of the approximate (rounded to the nearest 5 m) existing maximum fairway widths at each of the seven priority locations for a minimum functional water depth of 3.0 m is provided in Table 6-10. These widths are based on cross sections developed from the 2011 survey data.

Table 6-10: Approximate existing fairway widths at priority locations assuming a minimum functional water depth of 3.0 metres at mean low water spring tide

Location and Cross Section	Maximum functional bed level (AHD)	Approximate fairway width
Sackville Ferry 1	-3.30 m	5 m
Sackville Ferry 2	-3.30 m	0 m
Sackville Ferry 3	-3.30 m	35 m
Sackville Ferry 4	-3.30 m	80 m
Sackville Ferry 5	-3.30 m	125 m
Sackville Ferry 6	-3.30 m	135 m
Sackville Gorge 1	-3.20 m	135 m
Sackville Gorge 2	-3.20 m	70 m
Sackville Gorge 3	-3.20 m	75 m
Ebenezer Church 1	-3.20 m	105 m
Ebenezer Church 2	-3.20 m	100 m
Ebenezer Church 3	-3.20 m	80 m
Cattai Creek 1	-3.20 m	80 m
Cattai Creek 2	-3.20 m	100 m
Cattai Creek 3	-3.20 m	15 m
Sandy Point 1	-3.20 m	65 m
Sandy Point 2	-3.20 m	65 m
Sandy Point 3	-3.20 m	70 m
Pitt Town Bottoms 1	-3.20 m	90 m
Pitt Town Bottoms 2	-3.20 m	35 m
Pitt Town Bottoms 3	-3.20 m	100 m

Location and Cross Section	Maximum functional bed level (AHD)	Approximate fairway width
Pitt Town Bottoms 4	-3.20 m	95 m
Pitt Town Bottoms 5	-3.20 m	35 m
Ben's Point 1	-3.10 m	5 m
Ben's Point 2	-3.10 m	35 m
Ben's Point 3	-3.10 m	35 m

Assuming the alternative minimum functional water depth of 3.0 m, the ideal fairway width of 100 m (refer Section 6.1) is present in at least one cross section at Sackville Ferry, Ebenezer Church, Cattai Creek Pitt and Town Bottoms. A restricted, although acceptable, fairway width of 50 m or more is also present at in at least one cross section at all of the priority locations except Ben's Point.

In order to achieve a minimum functional water depth of 3.0 m for a fairway width of at least 50 m, dredging would be required at the following locations:

- Sackville Ferry (Cross Sections 1, 2 and 3)
- Cattai Creek (Cross Section 3)
- Pitt Town Bottoms (Cross Sections 2 and 5)
- Ben's Point (Cross Sections 1, 2 and 3)

It should be noted that, in order to achieve a minimum functional water depth of 3.0 m for the Hawkesbury River between Ben's Point and Sackville Ferry, dredging would likely be required along the length of this reach of the river. A detailed hydrographic survey of the river would be required to confirm the extent and volume of dredging required.

A range of relevant legislation would need to be reviewed if dredging were to be undertaken to achieve a minimum functional water depth of 3.0 m. This review of the legislation would need to consider the specific project details including the location, volume and capital investment value of the dredging and the mechanisms for ensuring that the provisions of current legislation are adhered to.

The legislative setting in relation to dredging is provided in Section 3, however the following is a summary of the approvals requirements expected to be required for dredging within the project area:

- Dredging to improve navigation in the project area would require consent under the provisions of Clause 69(3) of the Infrastructure SEPP (refer Section 3.2). The dredging would therefore be subject to the environmental assessment and approval requirements of Part 4 of the EP&A Act.

- Part 4 of the EP&A Act sets out the development assessment requirements for those developments that require consent. Part 4 generally requires the preparation of a Statement of Environmental Effects (SEE) or an Environmental Impact Statement (EIS), depending on the nature, location and capital investment value of the proposed development.
- Depending on the location of any proposed dredging, both Hawkesbury City Council and The Hills Shire Council may be the consent authorities for the work if it were to be undertaken under Part 4. Consideration of the requirements of Schedule 4A of the EP&A Act would also be relevant to establish if the Joint Regional Planning Panel (JRPP) is authorised to exercise consent authority functions of councils.
- Part 7 of the *Fisheries Management Act 1994* requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation. If the work were to be approved under Part 4 of the EP&A Act, the work would comprise integrated development (refer Section 3.1). If any marine vegetation, such as mangroves or seagrasses, was expected to be impacted through the dredging processes, a permit under Section 205 would also be required.
- Clause 11(6) of the Hawkesbury-Nepean River SREP provides development controls, including the requirement for consent, for extractive industries comprising maintenance dredging and extractive operations (refer Section 3.3). Consent is required under the provisions of Clause 11(7) for the filling of land, including through disposal of spoil from dredging, where filling exceeds 1 metre in depth, or an area of 100 square metres.
- Should dredging involve extraction of more than 30,000m^3 per year of extractive materials, dredging work would be declared a scheduled activity pursuant to Schedule 1 Part 1 of the *Protection of the Environment Operations Act 1997* (refer Section 3.8). As such, an Environmental Protection Licence would be required under the provisions of the *Protection of the Environment Operations Act 1997* to undertake dredging work, only if dredging of 30,000m^3 or more per year is required. However, an Environmental Protection Licence may be obtained for smaller dredging projects in order to protect the principal from prosecution relating to the discharge of pollutants to water.
- A licences may be required for the use of Crown land, including for the extraction of materials such as dredging of sand and gravel from waterways under the *Crown Lands Act 1989* (Section 49). Use of such materials for commercial purposes would also attract royalty payments on the materials removed in addition to annual rent paid on licences (Section 50). If no existing Crown lease is in place over the river authorising Hawkesbury City Council to undertake dredging, a licence would be required for the use of the Crown land.
- A ‘controlled activity approval’ is required under the *Water Management Act 2000* for controlled activities undertaken in, on or under waterfront land. Under Clause 38 of the Water Management (General) Regulation 2011, Hawkesbury City Council, a public authority, is exempt from the requirement to obtain a controlled activity approval and approval under the *Water Management Act 2000* is not required (refer Section 3.10).

- A number of matters of national environmental significance occur in the project area, including threatened and migratory species, threatened ecological communities, two Nationally Important Wetlands and a National Heritage Place. An assessment of the likely impacts on these matters would be required to determine if dredging was likely to cause a significant impact and thus require referral under the EPBC Act (refer Section 3.6).

7 DREDGING COSTS

Costs associated with dredging can be significant and vary depending on the volume and nature of material to be extracted, as well as the end use of the extracted material. A large component of dredging costs is associated with site establishment and disestablishment. It is estimated that site establishment and disestablishment costs for dredging in the project area would be in the order of $100,000. Dredging costs of around $10/m^3 would apply.

Widening of an existing channel of say 25 m to 100 m would require dredging of about 150 m^3 per metre length of river. For a 500 m stretch of river, this would equate to a dredge volume of around 75,000 m^3. Combined with site establishment and disestablishment, such dredging would be expected to cost around $850,000.

The above estimates generally align with typical dredge projects undertaken by the former Land and Property Management Authority (LPMA) as shown in Table 7-1.

Table 7-1: Estimated cost of typical LPMA dredging projects (Moses and Ling, 2010)

Category	Quantity	Indicative Cost
Major Dredging	60,000 cubic metres	$600,000 - $800,000
Medium Dredging	30,000 cubic metres	$400,000 - $500,000
Minor Dredging	20,000 cubic metres	$300,000 - $400,000

Costs associated with a Crown land licence (if required) would also need to be considered. The Department of Primary Industries Catchments and Lands website provides the following fees for Crown land licences.

Application for Licence

Application for revocation of a licence (or permissive occupancy) and issue of a new licence for the same purpose, except residential waterfront, to a new holder.	$383.60
Application for revocation of a licence (or permissive occupancy) and issue of a new licence for the same purpose (“transfer”) to a new holder over Crown land fronting a residential waterfront property	$438.40
Short Term Licence - application fee	$32.80

Note: The following costs will also be payable where applicable:

Site Investigation	Estimate
Land assessment – advertising (newspaper and gazette)	$213.70

Survey	
For issue of survey instruction and plan approval plus	$87.60
LPI lodgement where the applicant is authorised to arrange a survey of the land	+ survey fee
Estimated cost where the department carries out the survey plus plan approval and costs.	Estimate + $87.60 + survey fee
Non-survey where plan compiled plus fee	Estimate + fee
Advance towards processing costs of licence application – where the licence is to front a residential waterfront property.	$383.60
Security establishment fee for above in all cases.	$54.80
This amount will become the actual office costs component on granting of the lease.	($438.40)
Advance towards processing costs of licence application (other, eg grazing). This amount will become the actual office costs component on granting of the lease.	$383.60
Assessment of natural resource management implications and Part 5 EP&A Act requirements	
Estimated on magnitude of environmental assessment	Estimate
Requirement to lodge a species impact statement and/or environmental impact statement	$1,830.50
Valuation	
Standard minimum where rental value<$500	$32.80
Estimated where professional valuation is required	Estimate
Negotiation and re-processing of draft licence document	$109.60/hr
Application for alteration etc. of conditions of purpose	$151
Application for exemption from conditions	$151
Notice of appeal to local land board against minister's determination or redetermination of rent	$63
Application by former holder to remove improvements on forfeiture, surrender or determination of a holding	$151

As noted in Section 3.9, use of dredge materials for commercial purposes would also attract royalty payments on the materials removed in addition to licences fees and rent. Royalty revenue is recognised in accordance with AASB 118 Revenue on an accrual basis in accordance with the substance of the relevant agreement.

Past dredging projects have sought partnerships and beneficial use of dredged sediments to reduce overall dredging costs. For example, maintenance dredging projects in the Swansea Channel and Myall River utilised commercial sale of dredged material to offset the costs of dredging, as documented by Moses and Ling (2010). The Myall River project was completed for a net cost of $295,000, with savings of around $250,000 made, including through private sector sale of dredged material (Moses and Ling, 2010). These savings were reinvested into the project.

It should be noted that the bed of Myall River is Crown land and as such, the commercial sale of the dredged material required special approval from the then LPMA. This approval was provided on the basis that all funds from the sale of dredged material were reinvested into the project. Additionally, the material dredged from the Myall River and subsequently sold comprised clean sand, which would be expected to be more marketable than the bed and inside bend material that would be taken from the Hawkesbury River within the project area.

Based on the Myall River example, around 45% of dredging costs could potentially be offset through the sale of dredged material. In the case provided above for dredging within the project area, this would equate to a saving of around $382,500, leaving a project cost of $467,500.

8 SEDIMENT ANALYSIS

Based on the outcomes of the analyses provided in Section 6, it is considered that dredging is not required at any of the locations investigated. As a result, sediment sampling and analysis is not required.

If dredging were proposed, sampling of river sediments would be required to determine the type of material present and identify any contamination. After dredging requirements were established and agreed with Council and following a review of any existing data relevant to the contaminants of potential concern, a Sampling and Analysis Plan (SAP) would be prepared.

The SAP would describe the program to determine the physical and chemical characteristics of the sediment at depth across the dredge footprint. The physical particle sizing results would be analysed to assist in the assessment of proposed end use and disposal options. The results of the chemical analysis would be used to assess the suitability of the dredge material for beneficial reuse, waste classification for onshore disposal and suitability for disposal within the Hawkesbury River estuary.

9 CONCLUSIONS

Historical and recent hydrographic surveys of the Hawkesbury River show that the river bed in the project area is dynamic and the channel thalweg is constantly changing, albeit slowly. Changes comprise both scour and shoaling. It is likely that the Hawkesbury River in the project area undergoes periods of accretion during low flows, while experiencing net scour due to the effect of flood flows. Notwithstanding this, limited accretion is noted in some surveyed sections, which may be due to sediment supply from local stream bank erosion. In addition, secondary (helicoidal) flows are likely to move sediment from the outside to the inside of river bends, forming shoals on the inside bend from locally sourced sediment.

Based on available data and assumptions for navigation requirements of a 50 m to 100 m fairway, with an acceptable channel bed level of -1.9 m to -2.1 m AHD and below (i.e. a minimum functional water depth of 1.8 m), Ben's Point represents the only location that does not comply with navigation requirements. A navigable channel of as little as 25 m occurs at this location. However, this area is located within an existing reduced speed zone (4 knot limit) and as such is not used for water-skiing or wake-boarding. Dredging in this area would require planning approval and other licences. Without consideration of Crown land licence fees, royalties or revenue from the sale of dredged material, dredging in this area would be expected to cost in the order of $850,000. Although the potential exists for some dredging costs to be offset by the sale of dredged material, the cost of dredging would be expected to be high.

If an alternative minimum functional water depth of 3.0 m were to be adopted, along with a required fairway width of 50 m to 100 m, dredging would be required at Sackville Ferry, Cattai Creek, Pitt Town Bottoms and Ben's Point. Dredging in these areas would require planning approval and other licences.

The ability to utilise the sale of dredged material is dependent on the nature of materials and the proximity to a suitable market. If dredged material cannot be sold or beneficially reused, it would need to be side-cast into waters adjacent to the dredge channel. This process would carry its own risks, making the river shallower in those locations. Additionally, it is anticipated that any revenue from the sale of dredged material would be expected to be reinvested in the dredging project itself.

If dredging were proposed, it is expected that development consent would be required under Clause 69(3) of the Infrastructure SEPP. As dredging would be expected to require approvals under the *Fisheries Management Act 1994* and potentially the *Protection of the Environment Operations Act 1997*, it would comprise integrated development. Depending on the location of the dredging proposed, both Hawkesbury City Council and The Hills Shire Council may be the consent authorities for the work. Consideration to the requirements of Schedule 4A of the EP&A Act would also be required to establish if the JRPP would have a consent authority function.

Given the outcomes of the investigations undertaken, it is considered that a minimum functional water depth of 1.8 m is appropriate for the Hawkesbury River within the project area and the locations identified for investigation are currently navigable. Although navigation is somewhat restricted at Ben's Point, the existing controls, including vessel speed restrictions and marker buoys are considered adequate to manage this restriction.

As such, it is considered that dredging is not required at any of the investigations locations. Given the dynamic nature of the river, it is important that the location of navigational markers continue to be monitored and adjusted in response to shoaling and scouring occurring in the river.

10 REFERENCES

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APPENDIX A: MINUTES OF THE HAWKESBURY CITY COUNCIL FLOODPLAIN RISK MANAGEMENT COMMITTEE MEETING ON 18 APRIL 2011

Hawkesbury City Council

floodplain risk management advisory committee minutes

date of meeting: 18 April 2011
location: council chambers
time: 4:30 p.m.

FLOODPLAIN RISK MANAGEMENT ADVISORY COMMITTEE

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Meeting Date: 18 April 2011

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- **WELCOME**
- **APOLOGIES**
- **DECLARATION OF INTERESTS**
- **SECTION 1 - Confirmation of Minutes**
- **SECTION 2 - Notices of Motion**
- **SECTION 3 - Reports for Determination**
- **SECTION 4 - Reports for Information**
- **SECTION 5 - General Business**

FLOODPLAIN RISK MANAGEMENT ADVISORY COMMITTEE

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Meeting Date: 18 April 2011

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FLOODPLAIN RISK MANAGEMENT ADVISORY COMMITTEE

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Meeting Date: 18 April 2011

FLOODPLAIN RISK MANAGEMENT ADVISORY COMMITTEE

Meeting Date: 18 April 2011

Minutes of the Meeting of the Floodplain Risk Management Advisory Committee held in Council Committee Rooms, Windsor, on Monday, 18 April 2011, commencing at 4.33pm.

ATTENDANCE

Present:	Councillor Kevin Conolly - Chair Councillor Bob Porter - Deputy Chair Councillor Jill Reardon Councillor Paul Rasmussen Mr John Miller Mr Alexander (Phil) Windebank Mr Harry Panagopoulos - DECCW Mr Les Sheather Mr Peter Cinque Mr Ian Johnston Mr Geoffrey Bessell Mr Bill McMahon
Apologies:	Councillor Warwick Mackay Snr Inspector Robert Bowman Mr Ray Williams MP - Member for Hawkesbury Mr David Avery Mr Kevin Jones
In Attendance:	Mr Drew Bewsher - Bewsher Consulting Pty Ltd Mr Stephen Yeo - Bewsher Consulting Pty Ltd Mr Steve Black - NSW Maritime Mr Paul Greche - Department of Planning Mr Steven Molino - Molino Stewart P/L Mr Matthew Owens Mr Philip Pleffer Mr Chris Amit Ms Robyn Kozjak
Non Attendance:	Mr Chris Ransom

RESOLVED on the motion of Mr John Miller and seconded by Councillor Reardon that the apologies be accepted.

CONFIRMATION OF MINUTES

RESOLVED on the motion of Mr John Miller and seconded by Councillor Reardon that the Minutes of the Floodplain Risk Management Advisory Committee held on the 7 February 2011, be confirmed.

There were no interests declared in any items in the business paper.

Member	01/11/10	06/12/10	18/01/11	17/02/11	18/04/11	
Councillor Kevin Conolly - (Chair)	✓	✓	✓	✓	✓	
Councillor Bob Porter - (Deputy Chair)	✓	✓	✓	A	✓	
Councillor Warwick Mackay	A	A	A	A	A	
Councillor Paul Rasmussen	✓	✓	✓	✓	✓	
Councillor Jill Reardon	✓	✓	✓	✓	✓	
Mr Peter Cinque OAM - (SES Sydney Western Division)	A	✓	✓	A	✓	
Mr David Avery - (Dept. of Environment and Climate Change)	✓	✓	✓	✓	A	
Mr Chris Ransom – (Dept of Defence)	✓	✓	X	✓	X	
Snr Inspector Robert Bowman - (Industry & Investment NSW) - Primary Industries	X	X	✓	✓	A	
Mr Les Sheather - (Community Member)	✓	✓	A	✓	✓	
Mr Kevin Jones - (SES Headquarters)	✓	A	✓	✓	A	
Mr Geoffrey Bessell - (Community Member)	✓	✓	✓	✓	✓	
Mr John Miller - (Community Member)	✓	✓	✓	✓	✓	
Mr Bill McMahon - (Community Member)	✓	✓	✓	✓	✓	
Mr Alexander (Phil) Windebank	✓	✓	✓	✓	✓	
Mr Ian Johnston	✓	✓	✓	✓	✓	

Key: **A** = *Formal Apology* ✓ = *Present* **X** = *Absent - no apology*

Change to Order of Business:

Consultants Steve Molino, Drew Bewsher, Stephen Yeo and Paul Greche were acknowledged and it was agreed their presentations be brought forward from General Business to the front of the meeting.

MOTION:

RESOLVED on the motion of Councillor Reardon, seconded by Councillor Rasmussen.

Refer to COMMITTEE RECOMMENDATION

COMMITTEE RECOMMENDATION:

That the consultants' presentations be brought forward from the General Business section of the meeting to the front of the meeting.

- Mr Bewsher advised completion of the Study was imminent, advising it was anticipated the Study would be finalised by 30 June, 2011.

4.40pm - Peter Cinque arrived at the meeting.

5.08pm - Steve Black arrived at the meeting.

The presentation concluded at 6.00pm.

SECTION 3 - Reports for Determination

Item: 1 Evacuation Route Options Study for Bligh Park and Hobartville

DISCUSSION:

Due to time constraints, the complexity of the reports and the departure of some members of the Committee, it was agreed this item be deferred to a Special Meeting (to be scheduled after the Easter break). Mr Amit advised he would arrange for a representative from Bewsher Consulting to present the Study Reports to the Committee.

RECOMMENDATION TO COMMITTEE:

That the Committee recommend Council adopt the four reports in relation to the Bligh Park and Hobartville Evacuation Routes prepared by Bewsher Consulting Pty Ltd, as listed below:

- Bligh Park Evacuation Route Study - December 2007 - Reference J1434R_5
- Hobartville Evacuation Route Study - August 2008 - Reference J1434R_9
- Bligh Park Evacuation Route Options Study - March 2011 - Reference J1736R_9
- Hobartville Evacuation Route Options Study - March 2011 - Reference J1736R_10

MOTION:

RESOLVED on the motion of Mr Les Sheather, seconded by Councillor Reardon.

Refer to COMMITTEE RECOMMENDATION

COMMITTEE RECOMMENDATION:

That the Committee recommend this item be deferred to a Special Meeting (to be scheduled after the Easter break).

Item: 2 NSW Government's 2010/2011 Waterways Program for Pre-Dredging Investigations of the Hawkesbury River Between Windsor and Sackville

DISCUSSION:

- Mr Owens referred to the offer of financial assistance received through the Waterways Program for dredging investigations of the Hawkesbury River and to a resolution of Council on 29 March wherein it was resolved (in part):

  "A report on this matter be presented to the Floodplain Risk Management Advisory Committee requesting that the Committee identify and prioritise potential locations along the River between Windsor and Sackville that would provide the most cost benefit to the community."

Accordingly, the Chair called for specific areas of the river to be identified for investigation, in order of priority. The Committee subsequently agreed to the following:

1. Sackville Ferry
2. Sackville Gorge
3. Ebenezer Church
4. Pitt Town Bottoms
5. Sandy Point (near Grono Point)
6. Cattai Creek
7. Bens Point

Councillor Porter addressed Mr Black of NSW Maritime, thanking him for his assistance and input into this matter.

- Mr Black advised NSW Maritime chairs the Upper Hawkesbury User Group Committee which consists of representatives from boating related groups, advising the issue of dredging had been discussed at these meetings since 2001. Mr Black suggested having a Council officer attend the next meeting to provide some background and to confirm the areas which may be regarded as contentious. Councillor Porter declared he would be willing to attend the next UHUGC meeting.

RECOMMENDATION TO COMMITTEE

That:

1. The Committee identify potential locations along the River between Windsor and Sackville that would provide the most benefit to improving navigability of the river along this stretch.

2. After identifying potential locations in (1) above, the Committee then allocate a priority rating to these locations where the highest priority locations would provide the best cost/benefit to the wider river users and community.

3. NSW Maritime be requested to comment on the suggested priorities and also be requested to provide assistance with the hydro-graphic survey of the river in these locations.

MOTION:

RESOLVED on the motion of Councillor Rasmussen, seconded by Councillor Reardon.

Refer to COMMITTEE RECOMMENDATION

COMMITTEE RECOMMENDATION:

That the follow areas of the river be identified and prioritised as follows:

1. Sackville Ferry
2. Sackville Gorge
3. Ebenezer Church
4. Pitt Town Bottoms
5. Sandy Point (near Grono Point)
6. Cattai Creek
7. Bens Point

SECTION 5 - General Business

Nil.

The Meeting closed at 6.35pm.

APPENDIX B: MINUTES OF THE HAWKESBURY RIVER DREDGING INVESTIGATION PROJECT INCEPTION MEETING ON 2 MAY 2012

Project No: 301015-02986

Project: Hawkesbury River Dredging Investigations

Project Inception Meeting

PARTICIPANT NAME & ORGANISATION		DATE	2 May 2012
HAWKESBURY CITY COUNCIL	Prayog Pradhan (PP)		
	Matt Owens (MO)	TIME START	11:00am
WORLEYPARSONS	Nicole Cowlishaw (NC)	TIME FINISH	11:55am
	Lex Nielsen (LN)	LOCATION	Hawkesbury City Council 366 George St Windsor
		RECORDER	Nicole Cowlishaw
		DOC NO	301015-02986-MOM-0001

MINUTES OF MEETING

ITEM	ITEM DETAILS	ACTION BY AND DATE
1.	**Project Team Introductions**	
	Team members introduce themselves and provided an outline of their background and role of the project.	Note
2.	**Identification of Project Locations and Objectives**	
	The seven locations nominated for investigation in HCC's proposal were identified by the Hawkesbury Flood Risk Management Committee as areas requiring dredging. (MO)	Note
	The issues at the sites have largely been identified through anecdotal evidence. (MO)	Note
	These sites were put forward, discussed and supported at a Council Meeting. (MO)	Note
	The issues at the sites may have changed since the recent floods in late February / early March 2012. (MO)	Note
	The RMS monthly River Users Group is generally supportive that there is a problem at the identified sites. (MO)	Note
	The community is generally supportive of the proposal to dredge the identified areas. (MO)	Note
	There is an assumption from Council that the sale of dredged material needs to cover costs of dredging process. (MO)	Note
	Options for use or disposal of dredged sediment have not yet been considered. (MO)	Note

ITEM	ITEM DETAILS	ACTION BY AND DATE
	Land along the majority of the river is privately owned. (MO)	Note
	Bank stabilisation may be considered as a use for the dredged sediment. Council has approximately 300km of gravel roads, for which the dredged sediment could potentially be used. (PP)	Note
	An Estuary Management Plan is being developed by Council and may identify some potential uses for dredged sediment. (MO)	Note
	Council have survey data available from 1978-80, 1987-88 and from 2011 (Sydney Water). This will be provided to WorleyParsons. (PP)	Complete
	Data from RMS expected this week (by 4 May 2012). This data may not be in a format that is useful in preparing bed profiles. It will probably be visually compared with existing available data to determine if significant changes to bed profiles have occurred since the flood event in late February / early March. (LN)	LN/PP
	OEH may be able to provide survey capabilities if additional survey is required. Any discussions in this regard will be coordinated through Council. (LN)	Note
3.	**Overview of Services Proposed in Addendum 1**	
	Brief overview of services proposed in WorleyParsons' Addendum 1 was provided. (NC)	Note
4.	**Draft Program**	
	Draft Program was discussed. It was noted that the Draft Program included an error in the dates shown (Draft Program commenced 30/05/12 rather than 30/04/12). (NC)	Note
	Council review period to be increased to two (2) weeks. (MO)	Note
	Draft Program to be revised to correct dates and increase Council review period. (NC)	Complete (refer attached)
5.	**Information to be provided by HCC**	
	1978-80, 1987-88 and from 2011 (Sydney Water) data in xyz format to be provided to WorleyParsons.	Complete
	Figures showing seven identified locations to be provided to WorleyParsons.	Complete
6.	**Other Items**	
	Site inspection to be undertaken via Council boat 12:30pm to 3:30pm 2 May 2012. LN, NC, MO and PP to attend.	Note

END OF RECORD

APPENDIX C: NSW OFFICE OF ENVIRONMENT AND HERITAGE ATLAS OF NSW WILDLIFE SEARCH RESULTS

OEH Atlas of NSW Wildlife

Common name	Scientific name	NSW Status	Commonwealth Status	No. of records
FAUNA				
Amphibia				
Red-crowned Toadlet	*Pseudophryne australis*	Vulnerable		3
Green and Golden Bell Frog	*Litoria aurea*	Endangered	Vulnerable	7
Aves				
Freckled Duck	*Stictonetta naevosa*	Vulnerable		10
Black-necked Stork	*Ephippiorhynchus asiaticus*	Endangered		1
Australasian Bittern	*Botaurus poiciloptilus*	Endangered		2
Black Bittern	*Ixobrychus flavicollis*	Vulnerable		7
Square-tailed Kite	*^^Lophoictinia isura*	Vulnerable		4
Spotted Harrier	*Circus assimilis*	Vulnerable		3
Little Eagle	*Hieraaetus morphnoides*	Vulnerable		6
Comb-crested Jacana	*Irediparra gallinacea*	Vulnerable		6
Australian Painted Snipe	*Rostratula australis*	Endangered	Vulnerable	1
Curlew Sandpiper	*Calidris ferruginea*	Endangered	Migratory	12
Black-tailed Godwit	*Limosa limosa*	Vulnerable	Migratory	4
Gang-gang Cockatoo	*^^Callocephalon fimbriatum*	Vulnerable		11
Glossy Black-Cockatoo	*^Calyptorhynchus lathami*	Vulnerable		12
Major Mitchell's Cockatoo	*^Lophochroa leadbeateri*	Vulnerable		1
Swift Parrot	*^^Lathamus discolor*	Endangered	Endangered	3
Turquoise Parrot	*^^Neophema pulchella*	Vulnerable		1
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable		19
Barking Owl	*^^Ninox connivens*	Vulnerable		5
Powerful Owl	*^^Ninox strenua*	Vulnerable		17
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Vulnerable		3
Speckled Warbler	*Chthonicola sagittata*	Vulnerable		220
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Endangered	14
White-fronted Chat	*Epthianura albifrons*	Vulnerable		1
Painted Honeyeater	*Grantiella picta*	Vulnerable		1
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	Vulnerable		5
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable		24
Scarlet Robin	*Petroica boodang*	Vulnerable		7
Flame Robin	*Petroica phoenicea*	Vulnerable		3
Mammalia				
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable	Endangered	5
Yellow-bellied Glider	*Petaurus australis*	Vulnerable		16
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable		5
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable	7
Eastern Freetail-bat	*Mormopterus norfolkensis*	Vulnerable		16
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable		3
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	Vulnerable		4
Southern Myotis	*Myotis macropus*	Vulnerable		7
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Vulnerable		1
Cumberland Plain Land Snail	*Meridolum corneovirens*	Endangered		11
FLORA				
	Olearia cordata	Vulnerable	Vulnerable	1
	Tetratheca glandulosa	Vulnerable	Vulnerable	8
Black-eyed Susan	*Tetratheca juncea*	Vulnerable	Vulnerable	1
	Dillwynia tenuifolia	Vulnerable	Vulnerable	30
	Pultenaea parviflora	Endangered	Vulnerable	15
Downy Wattle	*Acacia pubescens*	Vulnerable	Vulnerable	42
Waterfall Greenhood	*^Pterostylis pulchella*	Vulnerable	Vulnerable	1
Juniper-leaved Grevillea	*Grevillea juniperina subsp.*	Vulnerable		4
Hairy Geebung	*Persoonia hirsuta*	Endangered	Endangered	3

Search criteria: Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Animals and Plants in selected area [North: -33.47 West: 150.81 East: 150.91 South: -33.61] returned a total of 593 records of 49 species.
Report generated on 25/06/2012 11:52 AM.

APPENDIX D: ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 PROTECTED MATTERS SEARCH TOOL SEARCH RESULTS

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

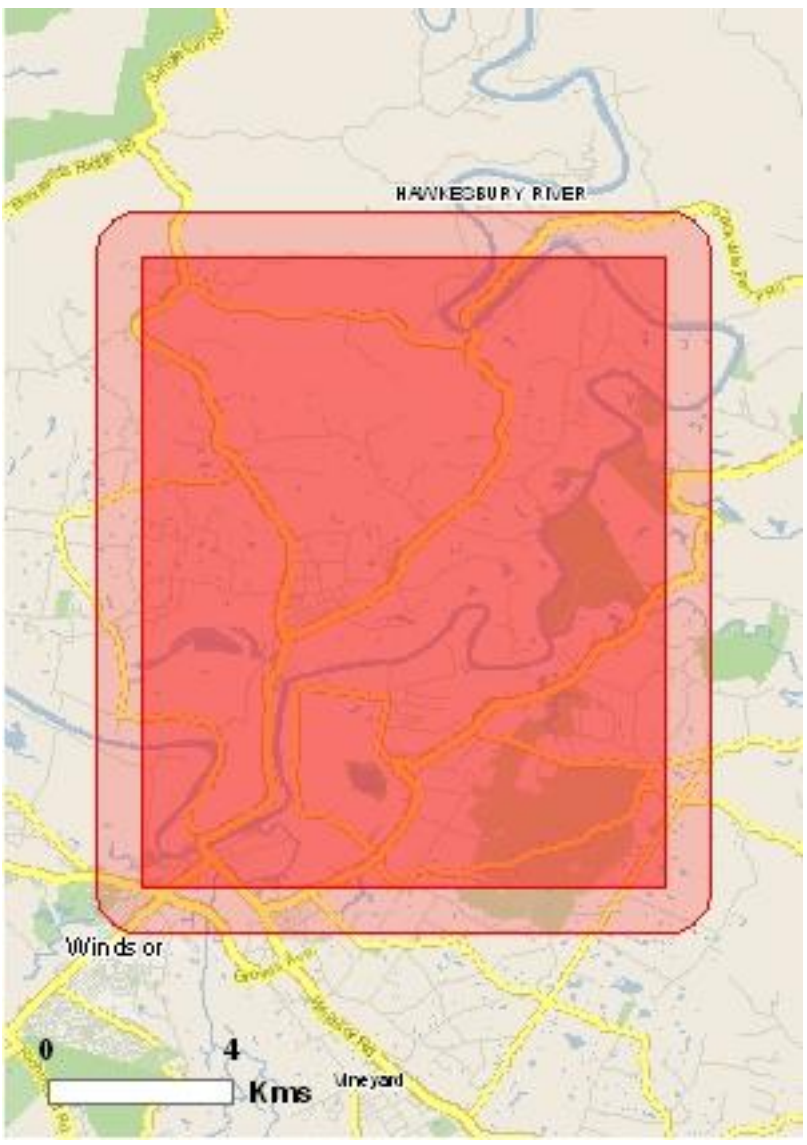
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

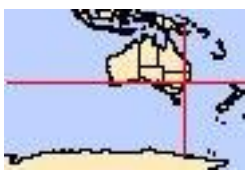
Report created: 15/06/12 11:46:16

Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	3
Threatened Species:	39
Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	7
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	73
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	19
Nationally Important Wetlands:	2

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
First Hawkesbury Farms	NSW	Nominated place

Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Shale/Sandstone Transition Forest	Endangered	Community likely to occur within area
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
FROGS		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANTS		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Acacia pubescens		
Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia elegans		
[56780]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Kunzea rupestris		
[8798]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca deanei		
Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Olearia cordata		
[6710]	Vulnerable	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345)		
Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Persoonia hirsuta		
[19006]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora		
[4182]	Vulnerable	Species or species habitat known to occur within area
Pimelea spicata		
[20834]	Endangered	Species or species habitat likely to occur within area
Pomaderris brunnea		
Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat known to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Tetratheca glandulosa Glandular Pink-bell [2350]	Vulnerable	Species or species habitat known to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
REPTILES		
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Telstra Corporation Limited
Defence - RICHMOND - FUEL FARM, DENTAL, MEDICAL
Defence - RICHMOND - MIDDLE MARKER

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Scheyville Bushland Remnant	NSW	Indicative Place
Longneck Lagoon Natural Area	NSW	Registered
Pitt Town Nature Reserve	NSW	Registered
Historic		
Arndells Windmill Complex	NSW	Indicative Place
Barrack Walls and Stables (former)	NSW	Indicative Place
Killarney Homestead	NSW	Indicative Place
Methodist Church (former)	NSW	Indicative Place
Trevallyn including Detached Wing and Slab Shed	NSW	Indicative Place
Windsor Post Office	NSW	Indicative Place
Bell Inn (former)	NSW	Registered
Bird in the Hand Inn (former)	NSW	Registered
Brick Cottage	NSW	Registered
Cad Die and Curtilage	NSW	Registered
Claremont Cottage and Curtilage	NSW	Registered
Cope House Group	NSW	Registered
Cottage	NSW	Registered
Courthouse Hotel (former)	NSW	Registered
Crescentville	NSW	Registered
Fairfield House, Gates and Curtilage	NSW	Registered
George Street Inn Group	NSW	Registered
Georgian Cottage	NSW	Registered
Georgian Cottage	NSW	Registered
Georgian House	NSW	Registered
Georgian Terrace of Two Houses	NSW	Registered
Georgian Terrace of Two Houses	NSW	Registered
Glenroy	NSW	Registered
House	NSW	Registered
House	NSW	Registered
House	NSW	Registered
House Excluding Modern Additions	NSW	Registered
House Old Section and Outbuildings	NSW	Registered
House and Outbuildings	NSW	Registered
Houses	NSW	Registered
Inn (former)	NSW	Registered
Inn (former)	NSW	Registered

Name	State	Status
Johnston Street Group	NSW	Registered
Little Church and Catherine Street Group	NSW	Registered
Loder House	NSW	Registered
Macquarie Arms Hotel	NSW	Registered
Macquarie School House	NSW	Registered
Manse of Ebenezer Church (former)	NSW	Registered
Mrs Copes House	NSW	Registered
North Street Group	NSW	Registered
Other Historic Buildings Bordering Thompson Square	NSW	Registered
Peninsula House Group	NSW	Registered
Public School Buildings	NSW	Registered
Reibycroft and Curtilage	NSW	Registered
Rose Cottage	NSW	Registered
Sackville Cemetery	NSW	Registered
School of Arts (former)	NSW	Registered
Scots Uniting Church	NSW	Registered
Shop With Residence Above	NSW	Registered
Small Brick Cottage	NSW	Registered
Springhill Farm House, Barn and Curtilage	NSW	Registered
St James Anglican Church	NSW	Registered
St James Anglican Church Group	NSW	Registered
St Johns Anglican Church	NSW	Registered
St Johns Anglican Church Group	NSW	Registered
St Matthews Anglican Church Group	NSW	Registered
St Matthews Rectory	NSW	Registered
St Thomas Anglican Church	NSW	Registered
Sunnybrae including Office, Grounds and Trees	NSW	Registered
Terrace of Three Houses	NSW	Registered
The Doctors House	NSW	Registered
The Toll House	NSW	Registered
Thompson Square	NSW	Registered
Thompson Square Precinct	NSW	Registered
Tizzana Winery	NSW	Registered
Uniting Church, Old Schoolhouse & Curtilage	NSW	Registered
Victorian Cottage	NSW	Registered
Victorian Cottage	NSW	Registered
Windsor Courthouse	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Cattai	NSW
Pitt Town	NSW
Scheyville	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
[Vulpes vulpes](#) Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
[Alternanthera philoxeroides](#) Alligator Weed [11620]		Species or species habitat likely to occur within area
[Asparagus asparagoides](#) Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
[Cabomba caroliniana](#) Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
[Chrysanthemoides monilifera](#) Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
[Genista sp. X Genista monspessulana](#) Broom [67538]		Species or species habitat may occur within area
[Lantana camara](#) Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
[Lycium ferocissimum](#) African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
[Nassella neesiana](#) Chilean Needle grass [67699]		Species or species habitat likely to occur within area
[Nassella trichotoma](#) Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
[Pinus radiata](#) Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
[Rubus fruticosus aggregate](#) Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
[Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii](#) Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
[Salvinia molesta](#) Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
[Ulex europaeus](#) Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
[Longneck Lagoon](#)	NSW
[Pitt Town Lagoon](#)	NSW

Coordinates

-33.48747 150.81024,-33.48747 150.91285,-33.61091 150.91285,-33.61091 150.81024,
-33.48747 150.81024

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium

-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX E: NSW OFFICE OF ENVIRONMENT AND HERITAGE ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM (AHIMS) SEARCH RESULTS

AHIMS Web Services (AWS)
Search Result

Your Ref Number : HawkesburyRiverDredging 1

Client Service ID : 72535

Nicole Cowlishaw
141 Walker St
North Sydney New South Wales 2060
Attention: Nicole Cowlishaw
Email: nicole.cowlishaw@worleyparsons.com

Date: 15 June 2012

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : 150.81024, -33.54919 - Lat, Long To : -33.48747, 150.91285 with a Buffer of 0 meters. conducted by Nicole Cowlishaw on 15 June 2012

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

42	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

AHIMS Web Services (AWS)
Search Result

Your Ref Number : HawkesburyRiverDredging 2

Client Service ID : 72536

Nicole Cowlishaw
141 Walker St
North Sydney New South Wales 2060
Attention: Nicole Cowlishaw
Email: nicole.cowlishaw@worleyparsons.com

Date: 15 June 2012

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : 150.81024, -33.61091 - Lat, Long To : -33.54919, 150.91285 with a Buffer of 0 meters. conducted by Nicole Cowlishaw on 15 June 2012

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

79	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

APPENDIX F: SITE INSPECTION PHOTOGRAPHS

Sackville Ferry






WorleyParsons

resources & energy

HAWKESBURY CITY COUNCIL
HAWKESBURY RIVER DREDGING INVESTIGATIONS
SUMMARY REPORT







Sackville Gorge






Ebenezer Church


Cattai Creek

Sandy Point







Pitt Town Bottoms




Ben's Point






HAWKESBURY CITY COUNCIL
HAWKESBURY RIVER DREDGING INVESTIGATIONS
SUMMARY REPORT

APPENDIX G: SOURCE, CONTENT AND PROCESSING OF RIVER BED SURVEY DATA

Data Sources

Three data sets were provided by Hawkesbury City Council for analysis. These data sets comprised historic data from 1978 - 1980 and from 1987-1988. The third data set comprised survey data obtained by Sydney Water in late 2011. The content and characteristics of these data sets are described in the following tables.

Soundings recorded in May 2012 were also supplied by NSW Roads and Maritime Services (RMS) at the request of Hawkesbury City Council. A copy of these soundings is provided at Appendix J.

1978 - 1980 survey data

	Comments
File type supplied	.xyz and .kmz files provided.
Coordinate system	MGA Zone 56, GDA 94.
Datum	AHD
Survey location	Data extent from Cattai Creek in the south, beyond Sackville Ferry past the Colo River junction to downstream junction of Webbs Creek and the Hawkesbury River. Cross sections of the Colo River are provided upstream to Colo.
Information	Point data with x,y,z coordinates. Multiple points along cross sections taken at intervals down the river. Survey points at inconsistent intervals within each cross section, ranging from < 1m to > 25 m between points.
Location of cross sections	At consistent intervals within the Study Location.
Typical cross section width	220 m
Average distance between cross sections	Approx. 450 m – 550 m
Maximum distance between sections	Approx. 600 m
Minimum distance between cross sections	Approx. 150 m

1987-1988 survey data

	Comments
File type supplied	.xyz and .kmz files provided.
Coordinate system	MGA Zone 56, GDA 94.
Datum	AHD
Survey location	Data extent from the western bend at Ben's Point (in the south) to Cattai Creek in the North, approximately 500 m upstream of the first cross section in the 1978-1980 data set.
Information	Point data with x,y,z coordinates. Multiple points along cross sections taken at intervals down the river. Survey points at inconsistent intervals within each cross section, ranging from < 1 m to > 25 m between points.
Location of cross sections	At consistent intervals within the Study Location.
Typical cross section width	Approx. 260 m for major sections Approx. 140 m for minor sections
Average distance between cross sections	Major cross sections approx. every 450 m to 550 m Minor cross sections approx. every 50 m
Maximum distance between sections	Approx. 600 m
Minimum distance between cross sections	Approx. 50 m generally, and 15 m at bends

2011 survey data

	Comments
File type supplied	.xyz and .kmz files provided.
Coordinate system	MGA Zone 56, GDA 94.
Datum	AHD
Survey location	Hawkesbury River from the western bend at Ben's Point (in the south) to 2 km west of the Sackville Ferry (in the north). Refer Hawkesbury City Council Study Location Map.
Information	Point data with x,y,z coordinates. Multiple points along cross sections taken at intervals down the river. Points generally at consistent 2m intervals within each section.
Location of cross sections	At consistent intervals within the Study Location. Cross sections surveyed at the same locations as the 1978-1980 data (northern data from Cattai Creek to Sackville Ferry) and at the same major locations (wider cross sections) as the 1987-1988 data (southern data from Ben's Point to Cattai Creek).
Typical cross section width	The 2011 surveyed cross sections are not as wide as the original surveyed 1978-1980 cross sections or major sections from the 1987-1988 survey. Average cross section width is noted as 110 m to 150 m.
Average distance between cross sections	350 m – 450 m
Maximum distance between sections	Approx. 600 m
Minimum distance between cross sections	Approx. 150 m
Location of scarce data	• 4 x cross sections over 450 m between Pitt Town Bottom's and Sandy Point. This reach appears to constrict between wider sections of the Hawkesbury River. • 12 X cross sections over 2100 m east of the Sackville Ferry. Aerial inspection using Google Earth shows this reach to be very straight and of consistent width.

Data conversion processes

Survey Data

A number of surveyed cross sections at each of location were identified. The point data was extracted and converted to cross-sectional strings using the Mat Lab program.

At each cross section considered, the 2011 data overlapped with either the 1978-1980 or the 1987-1988 data set, however each data point within the cross section was not at exactly the same position. Since the profiles were not exactly coincident, the Mat Lab script created a 'line of best fit' between both cross sections. The script effectively interpolates and plots the points from each cross section along the 'line of best fit' which then plot onto a figure for comparison.

Additionally, for visual purposes, where the first or last point along any cross section was below 0 mAHD, the Mat Lab script generated an artificial point 1 m from the true point which plots at an elevation of 0 mAHD. This should be kept in mind when viewing the cross sections prepared.

Soundings Data

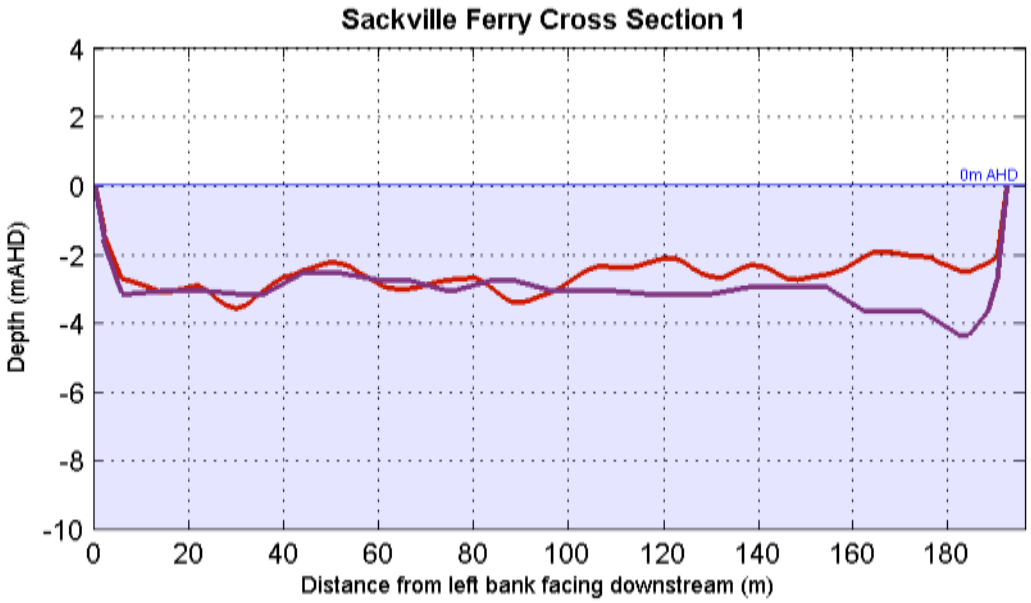
RMS soundings images were used to manually create point x,y,z data for each point given as an image. Each point's z elevation value was adjusted to AHD based on the date and time the image was taken, using the tide data purchased. Using a GIS mapping program, the RMS soundings points were brought up for viewing.

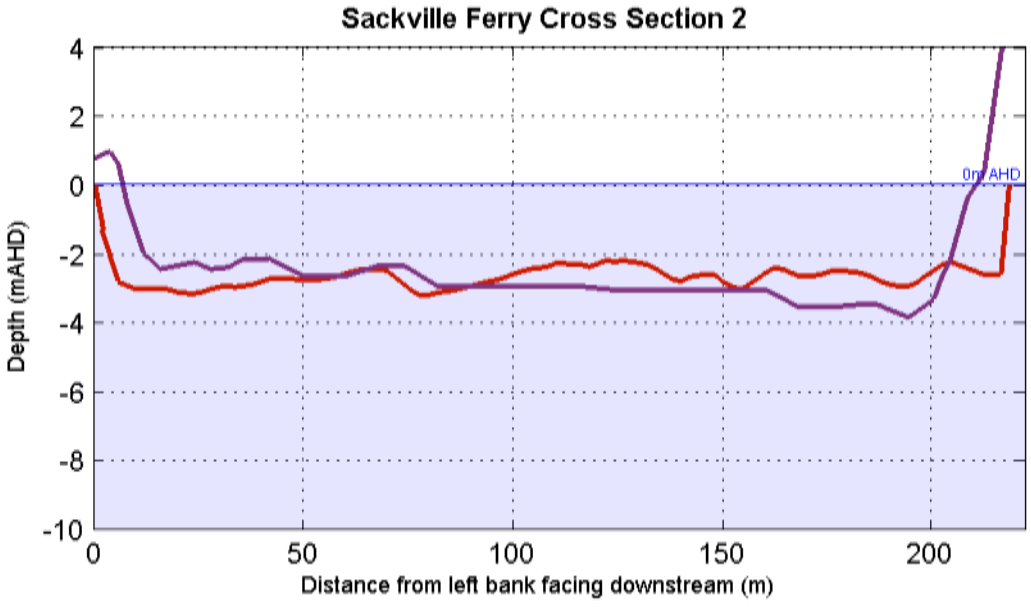
The 2011 survey was brought up to find which sections were closest to the sounding cross sections. All sections except that taken at Ben's Point, were further than 100m from 2011 surveyed sections.

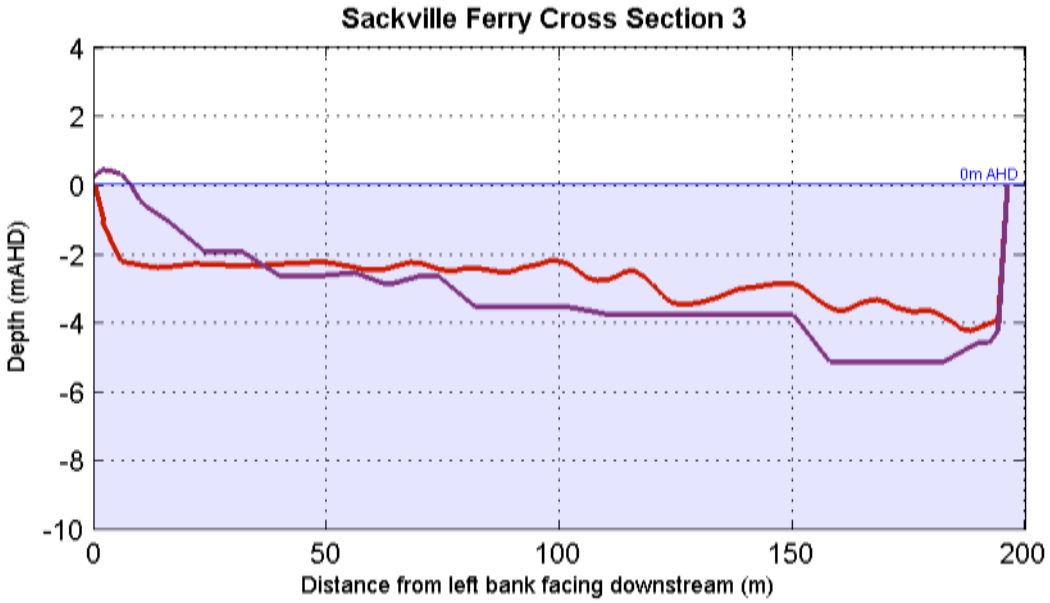
The Mat Lab script was used to create a 'line of best fit' between sections the sections chosen for comparison. This works by interpolating the points along each cross section and mapping them onto the line of best fit. Because the soundings were over 100m from the sections, the 'line of best fit' would be approximately 50m from either true cross section. It was better to maintain the true location of the 2011 survey data by artificially adjusting the x and y coordinates of the soundings points to bring them closer to the section for comparison, and reducing the distance between the cross sections and 'line of best fit' which is what is plotted onto the figure. This is justified because the soundings have a fraction of the points compared to the bathymetry data from the 2011 survey, and the nature of the soundings is simply not as accurate as that of bathymetry data.

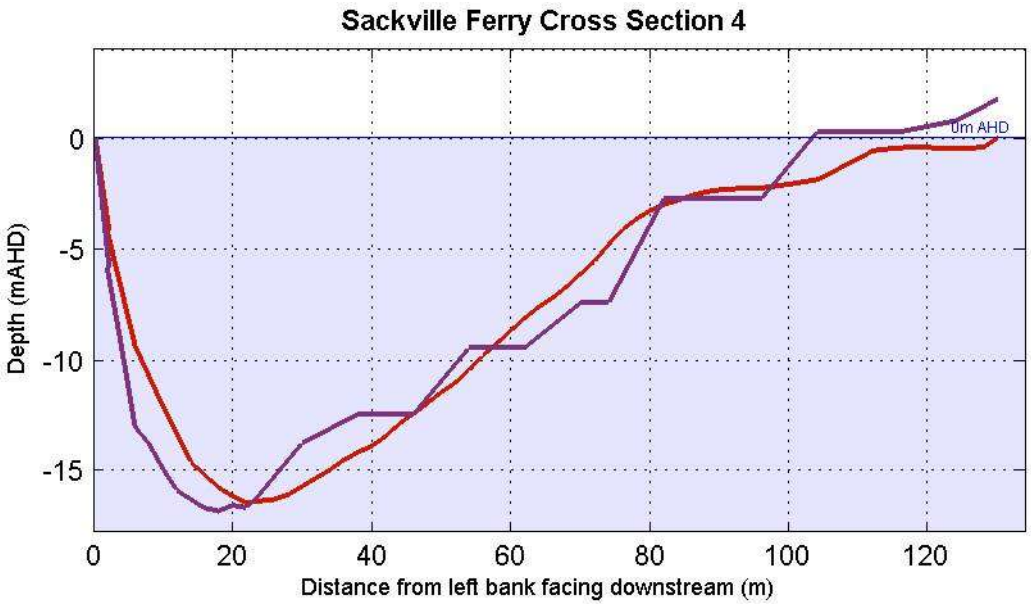
APPENDIX H: CROSS SECTIONS SHOWING HISTORIC RIVER BED CHANGE

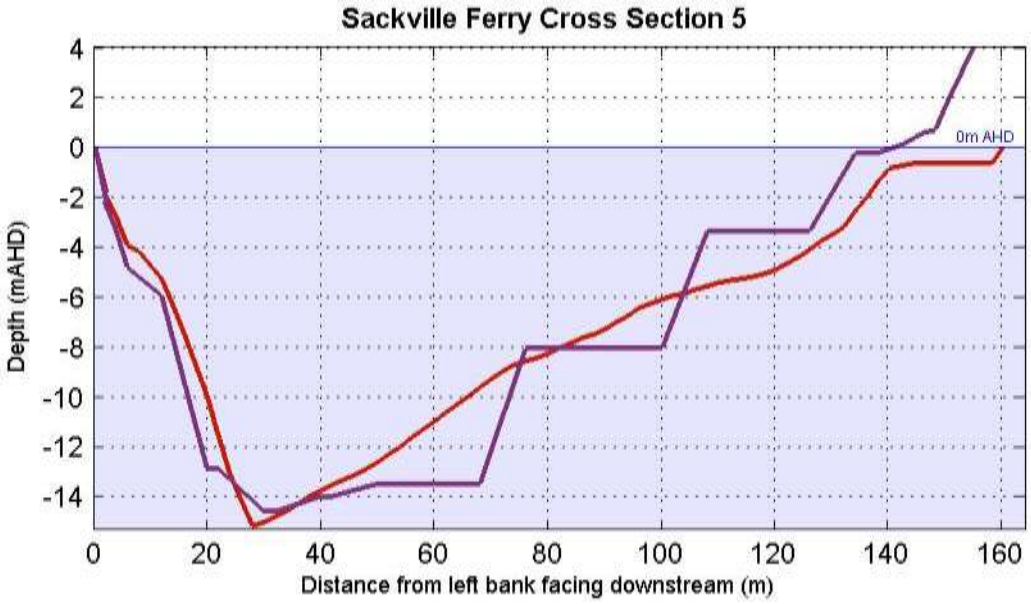
Sackville Ferry

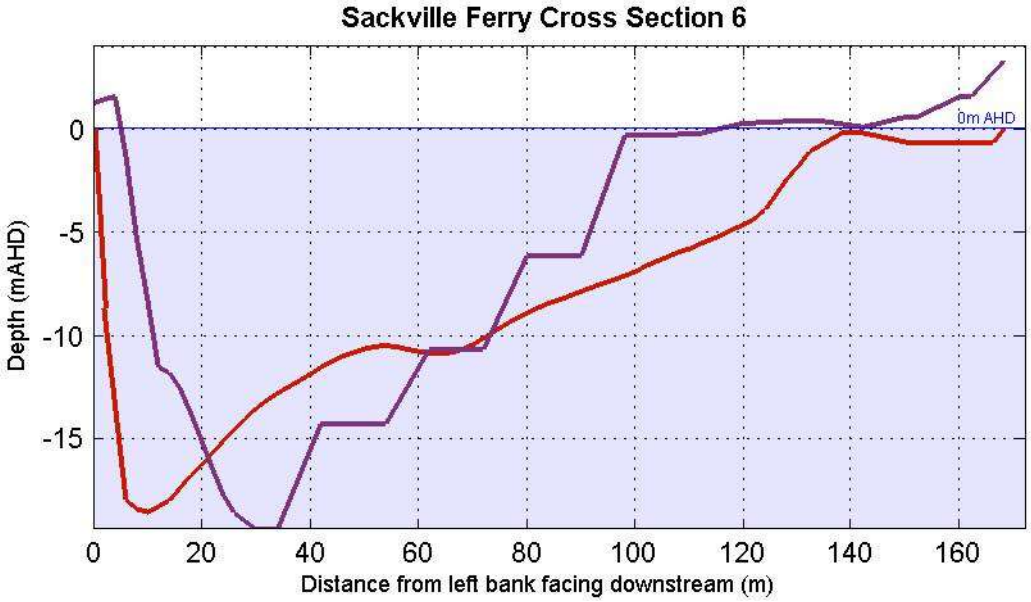




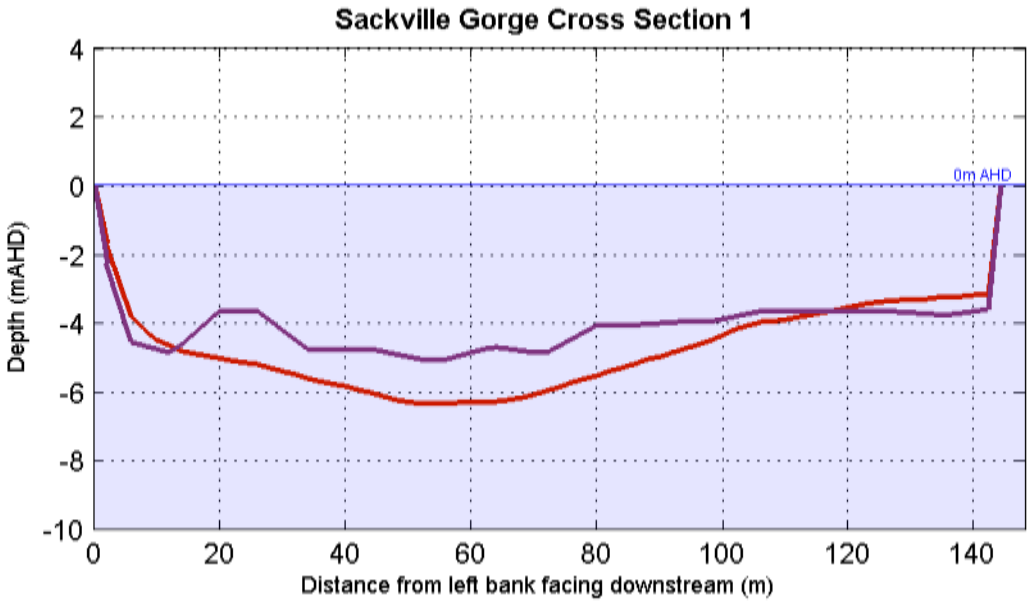

Sackville Ferry Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
50
100
150
200

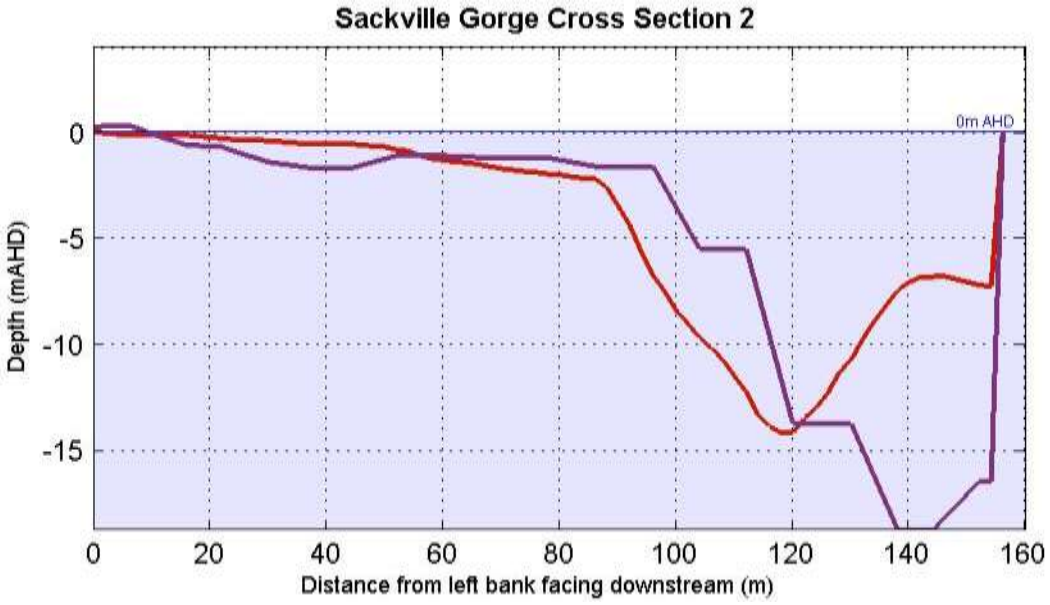

Sackville Ferry Cross Section 4
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
0
-5
-10
-15
0
20
40
60
80
100
120

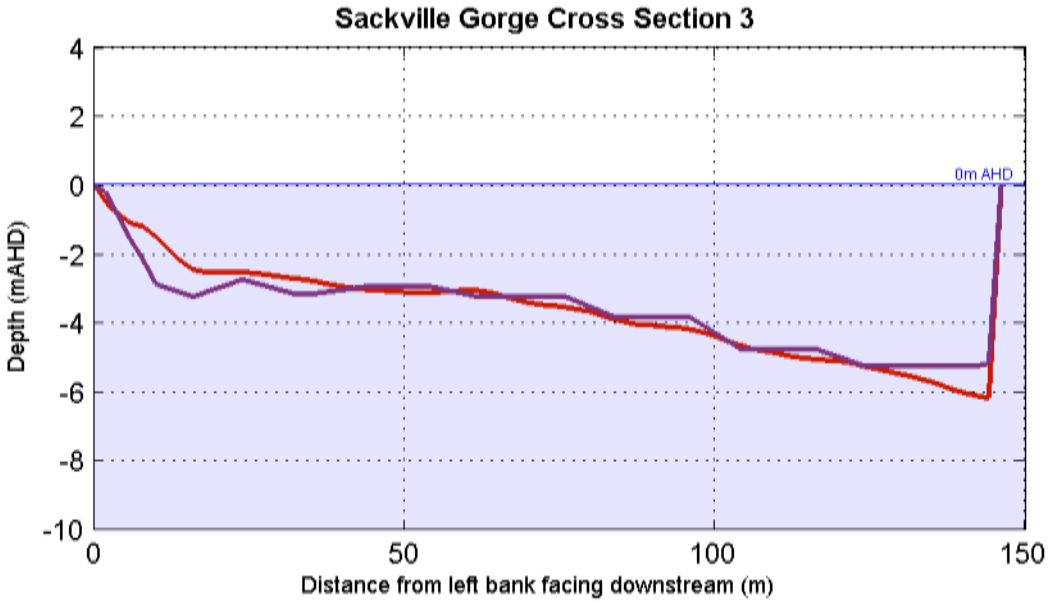

Sackville Ferry Cross Section 5
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
-12
-14
0
20
40
60
80
100
120
140
160


Sackville Ferry Cross Section 6
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
0
-5
-10
-15
0
20
40
60
80
100
120
140
160

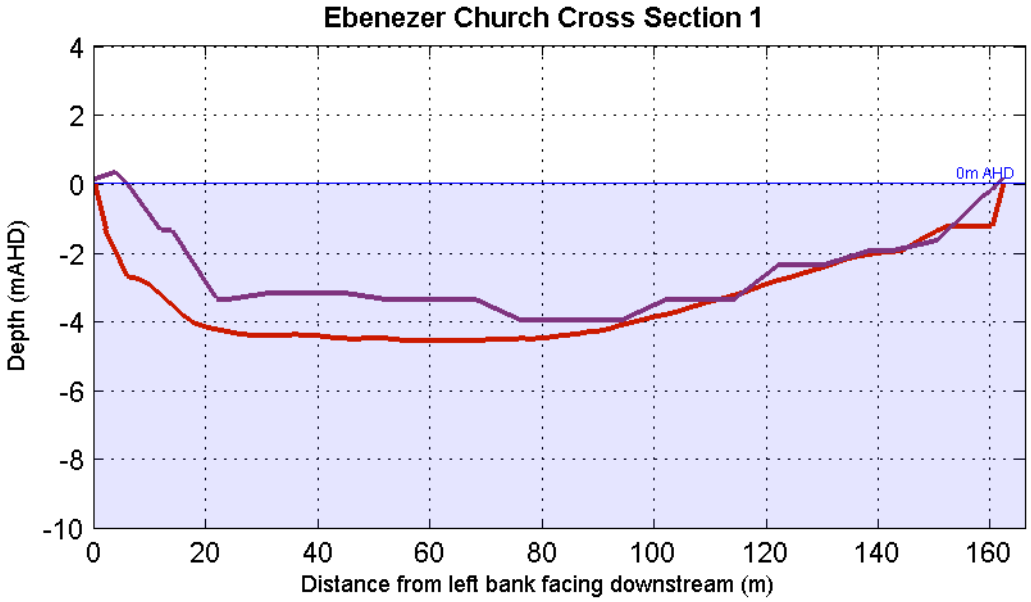
Sackville Gorge

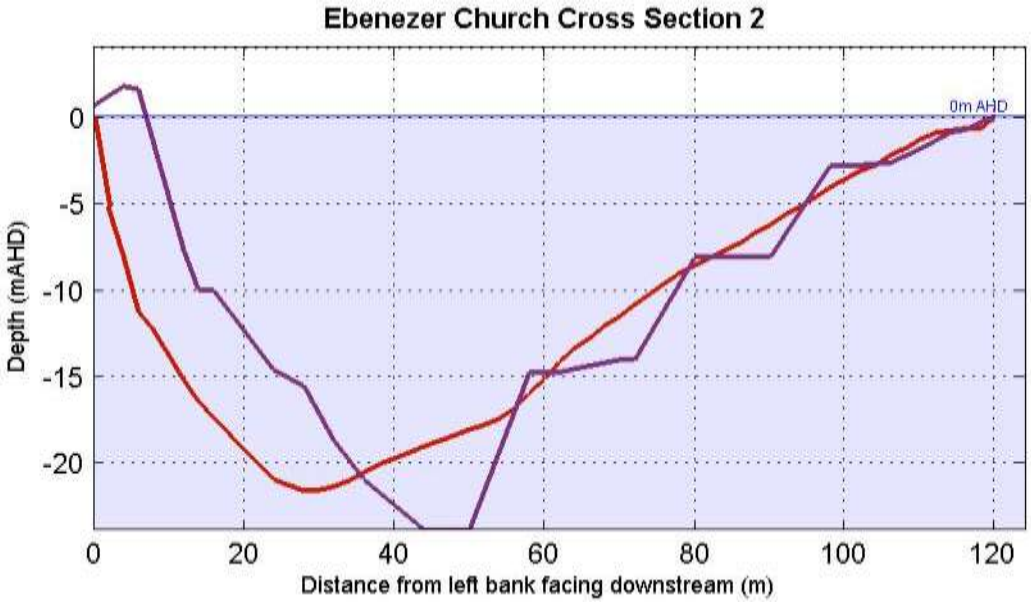


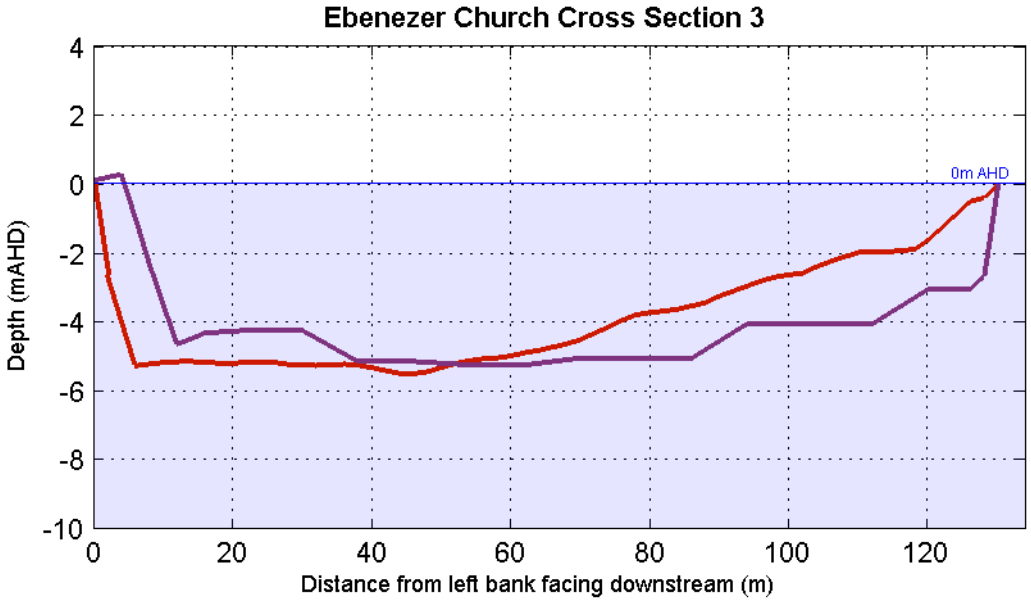




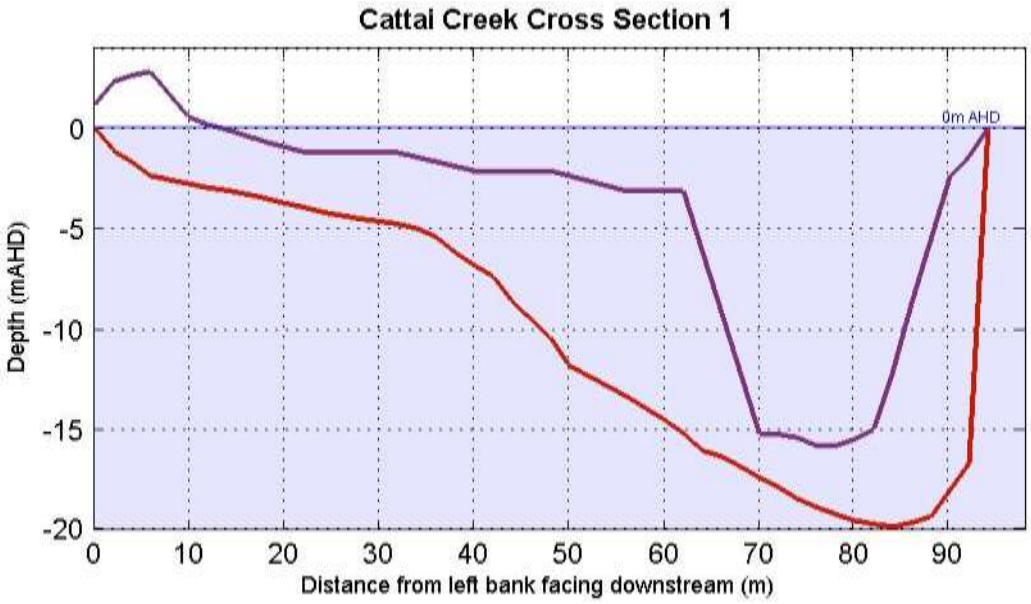
Ebenezer Church

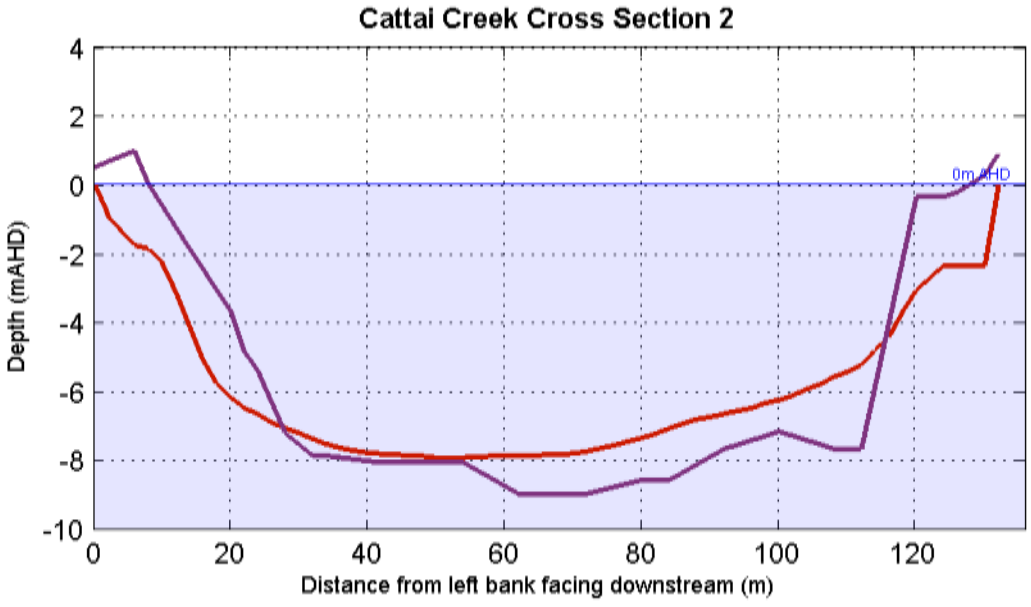


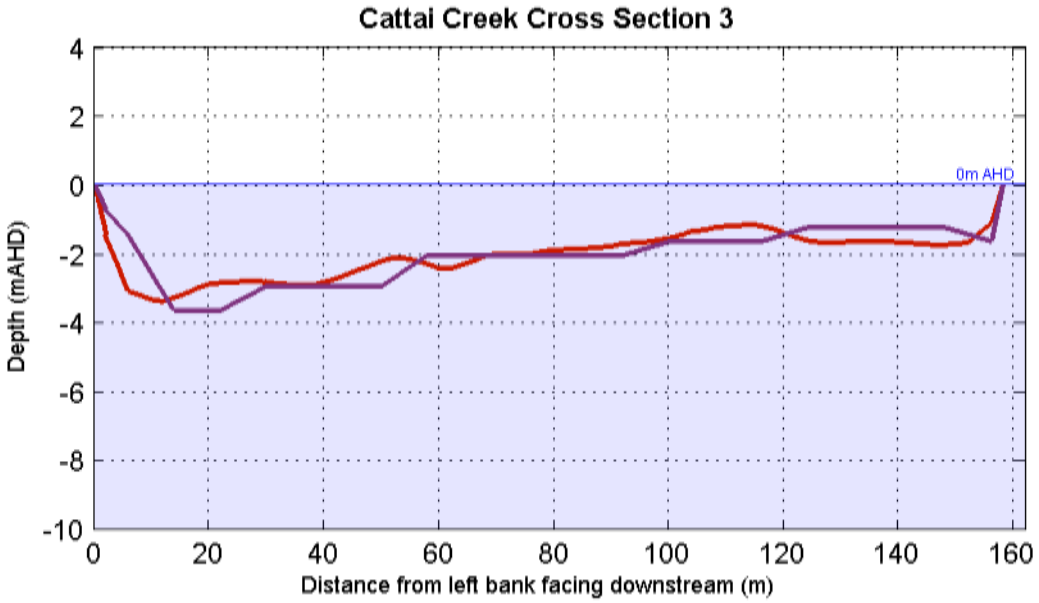

Ebenezer Church Cross Section 2
0m AHD
Depth (mAHD)
0
-5
-10
-15
-20
0
20
40
60
80
100
120
Distance from left bank facing downstream (m)


Ebenezer Church Cross Section 3
0m AHD
Depth (mAHD)
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
Distance from left bank facing downstream (m)

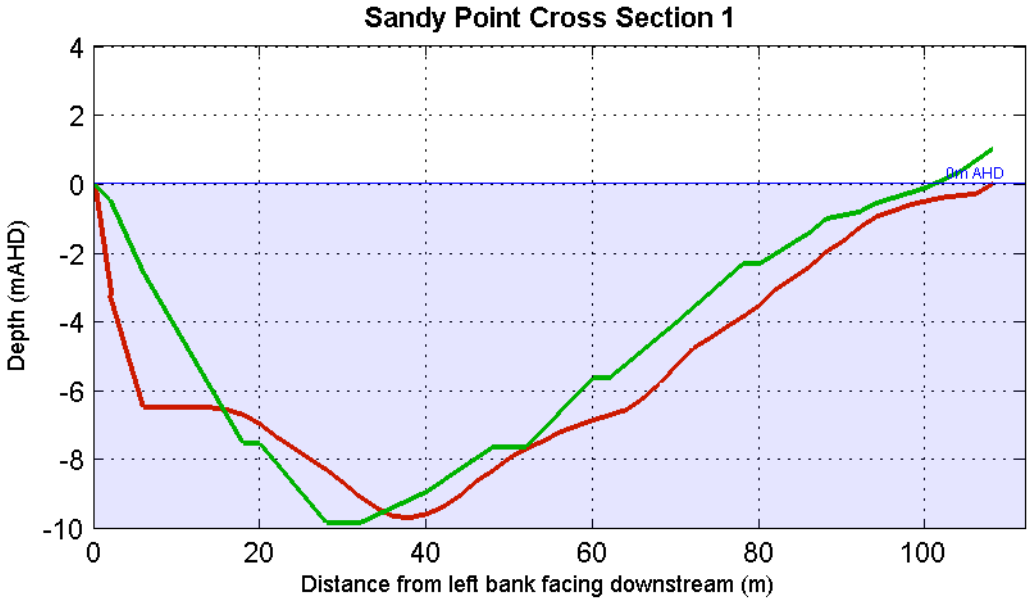
Cattai Creek

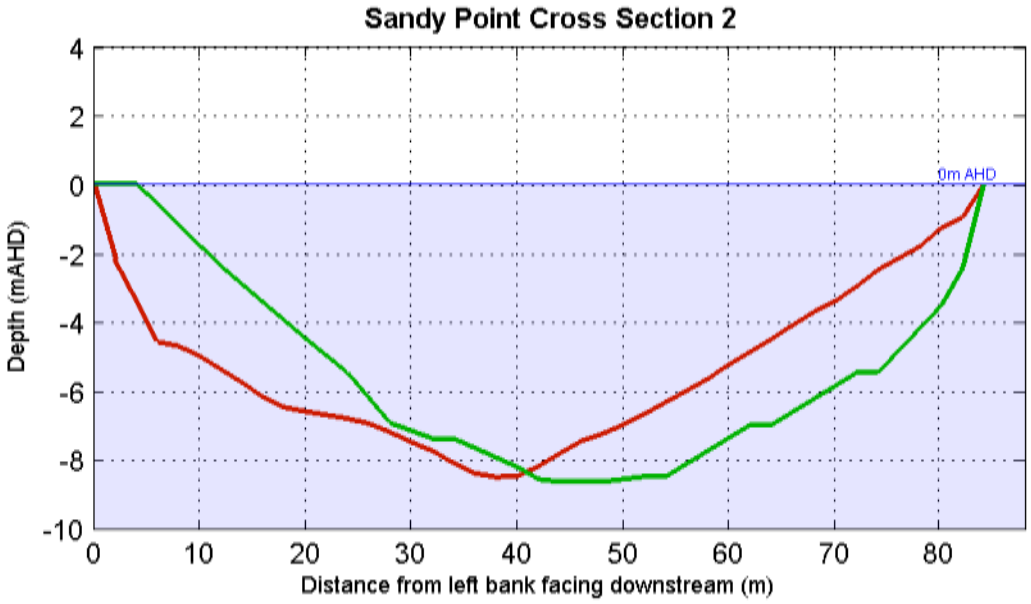


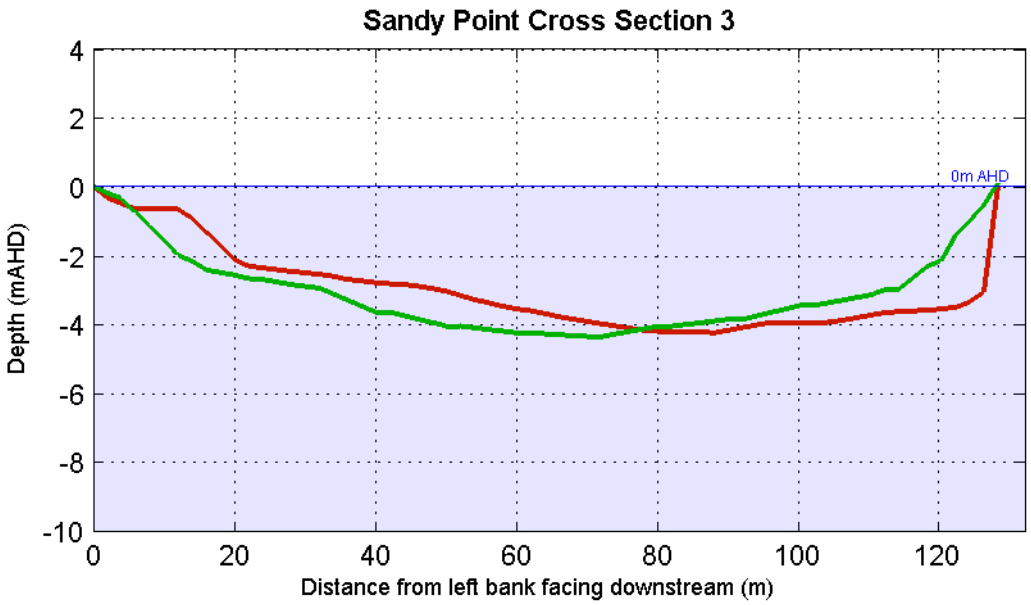



Cattai Creek Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
140
160

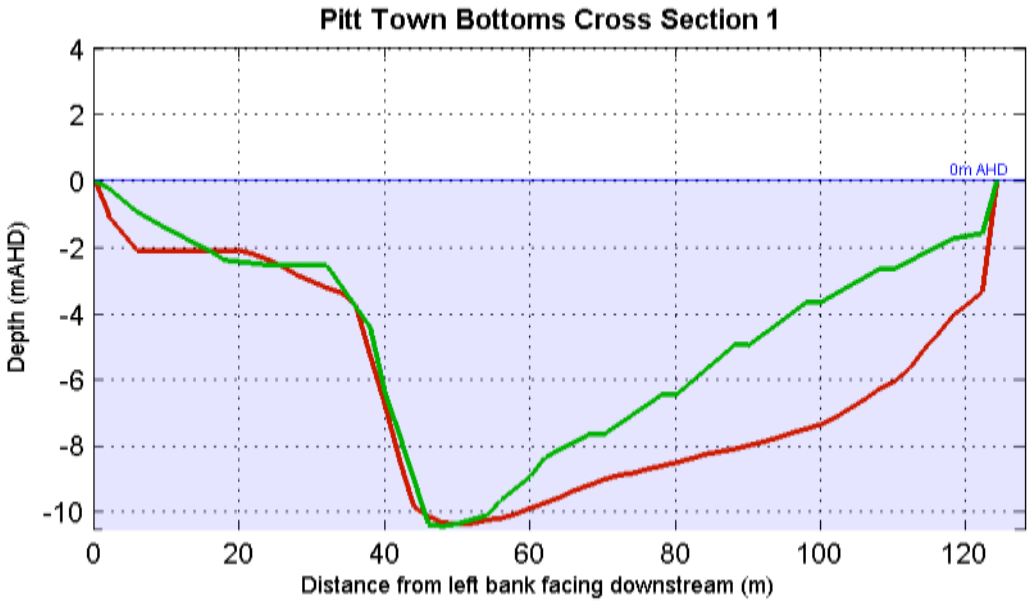
Sandy Point

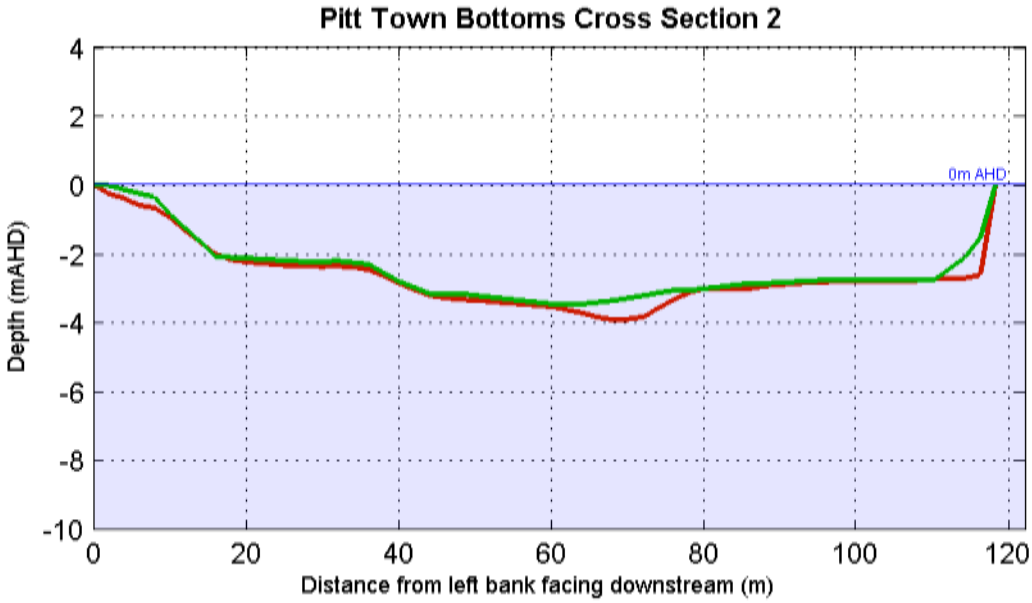

Sandy Point Cross Section 1
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100

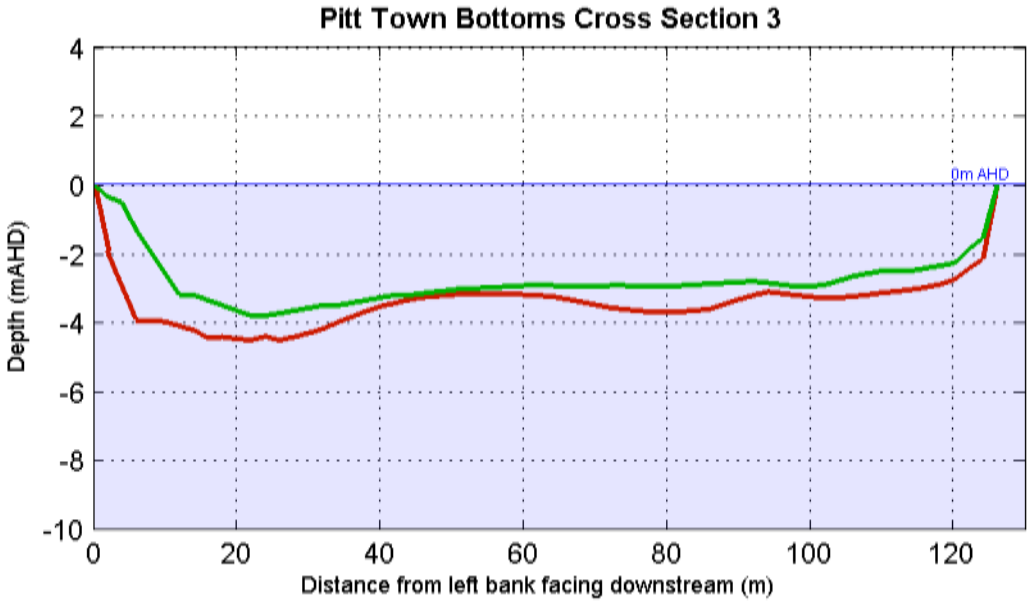

Sandy Point Cross Section 2
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60
70
80

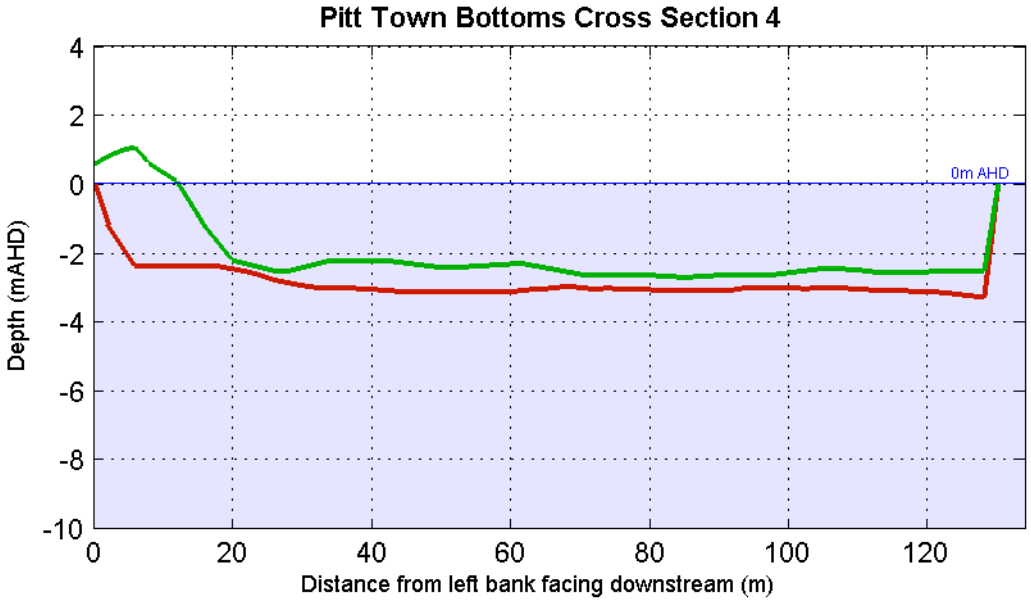

Sandy Point Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120

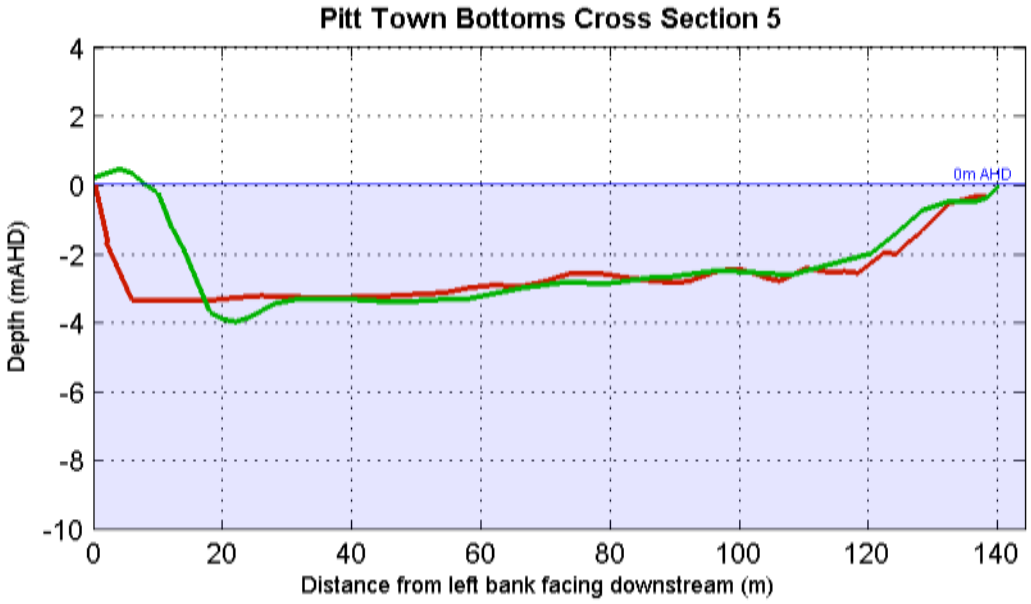
Pitt Town Bottoms



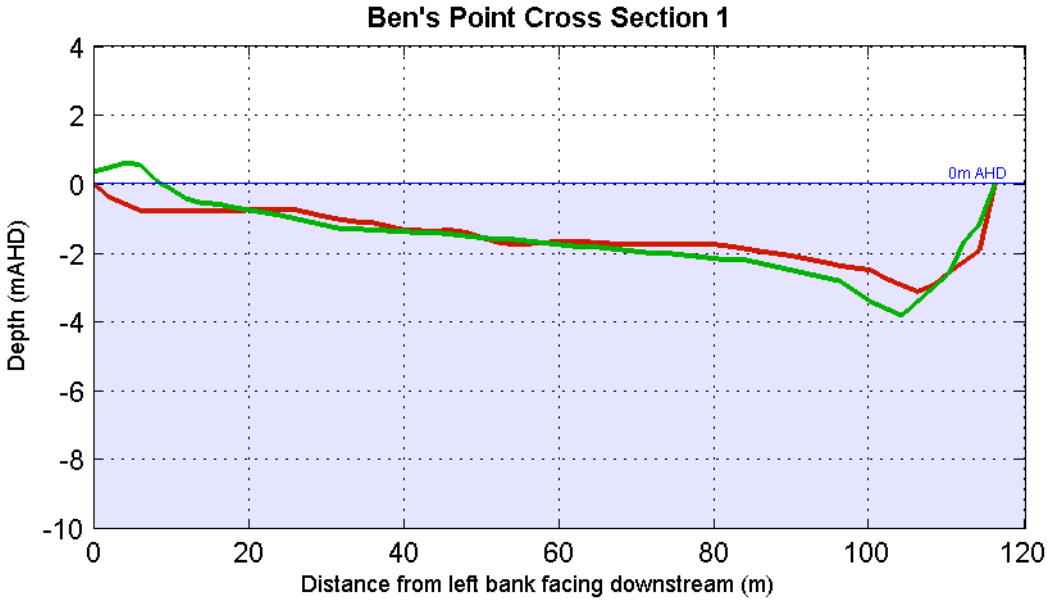


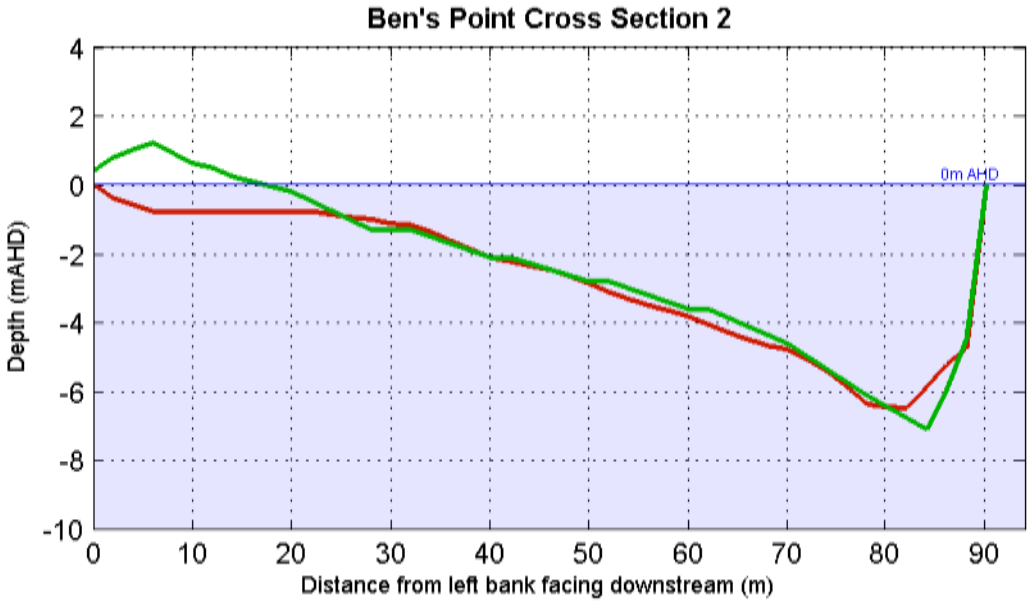

Pitt Town Bottoms Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120

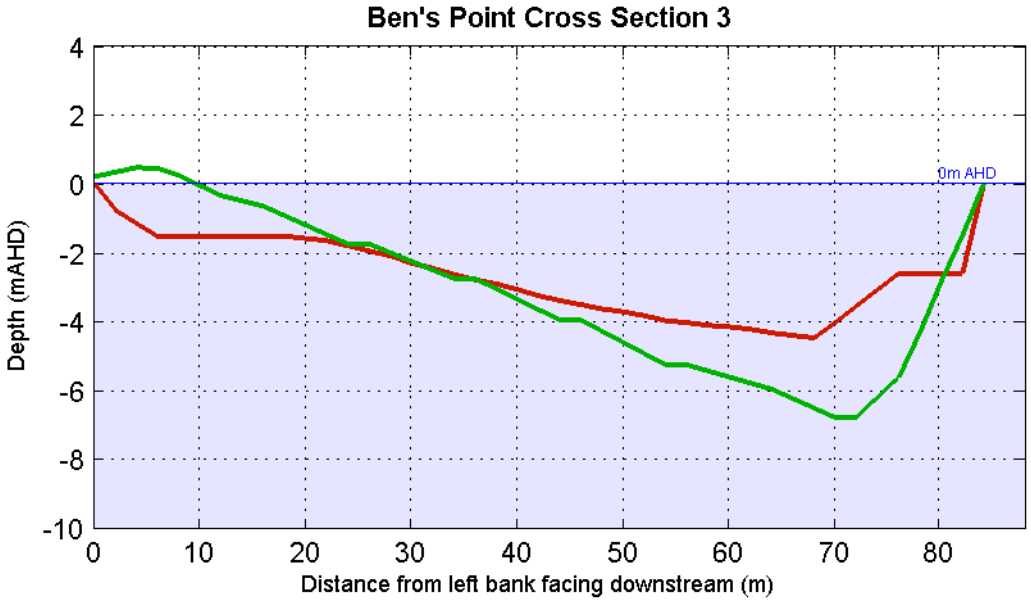

Pitt Town Bottoms Cross Section 4
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120


Pitt Town Bottoms Cross Section 5
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
140

Bens Point

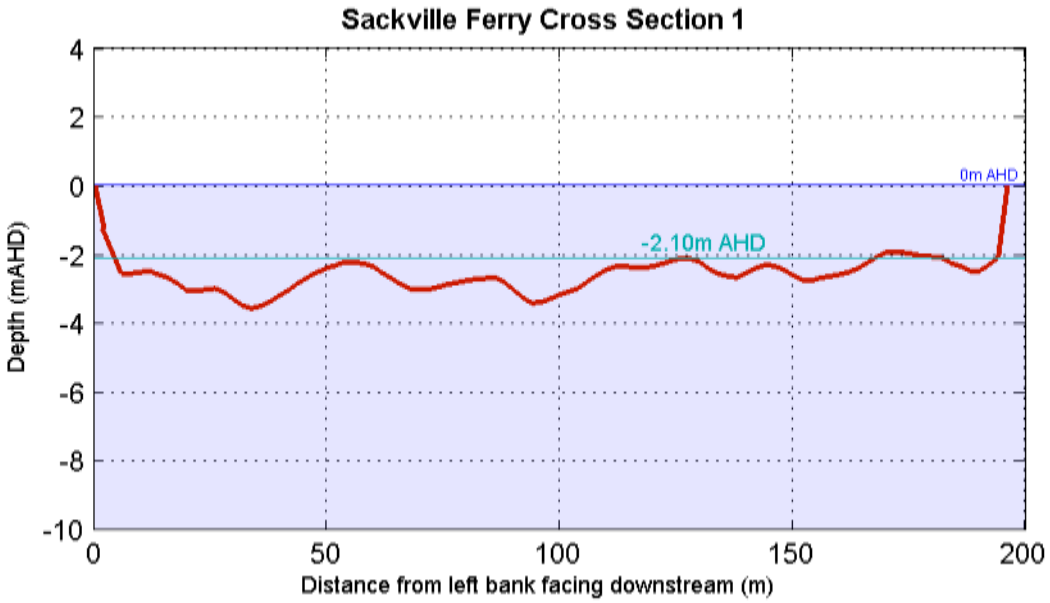

Ben's Point Cross Section 1
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120

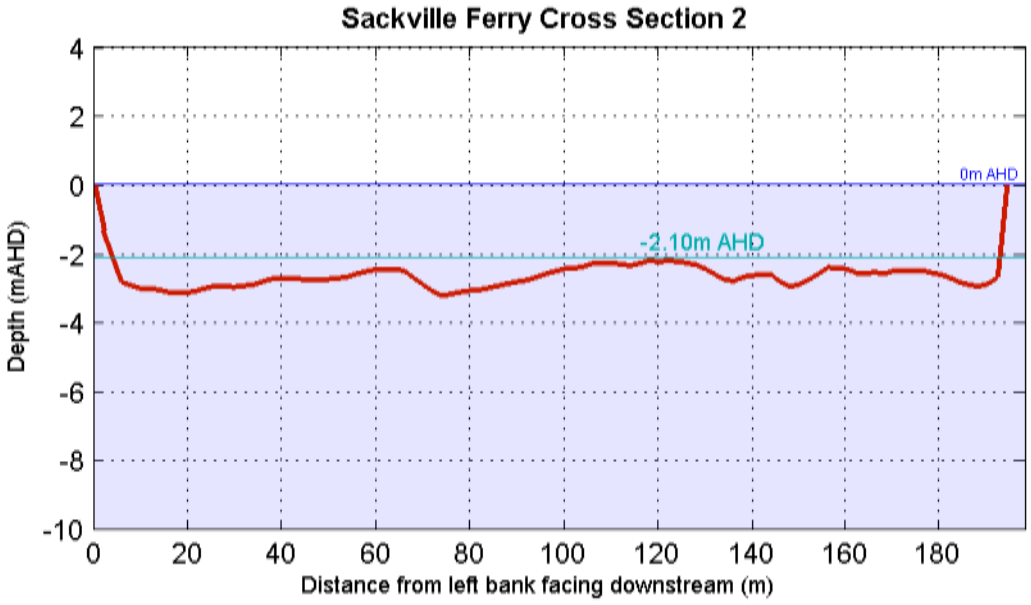

Ben's Point Cross Section 2
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60
70
80
90

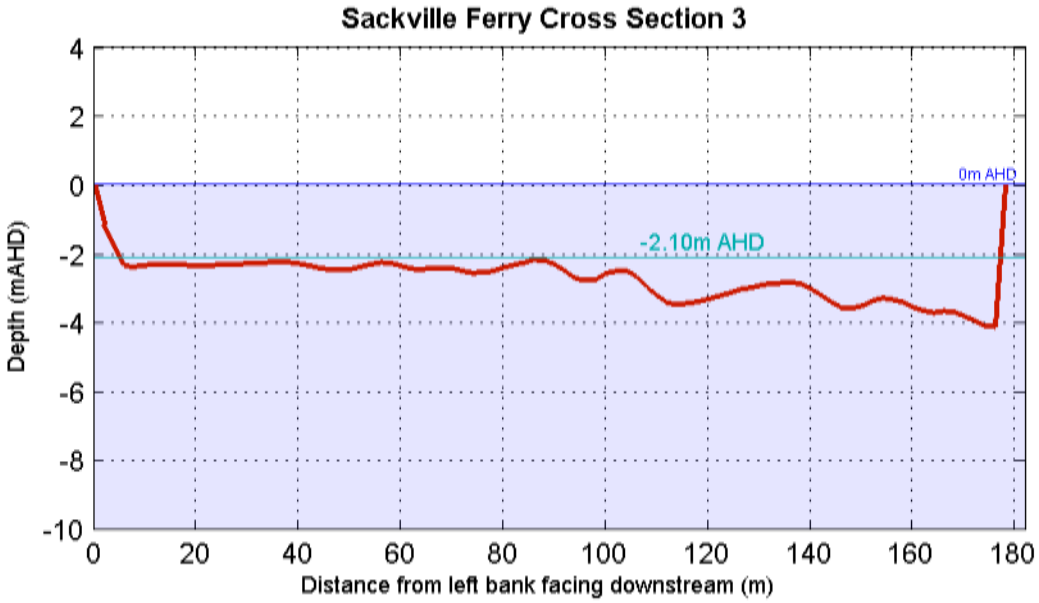

Ben's Point Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60
70
80

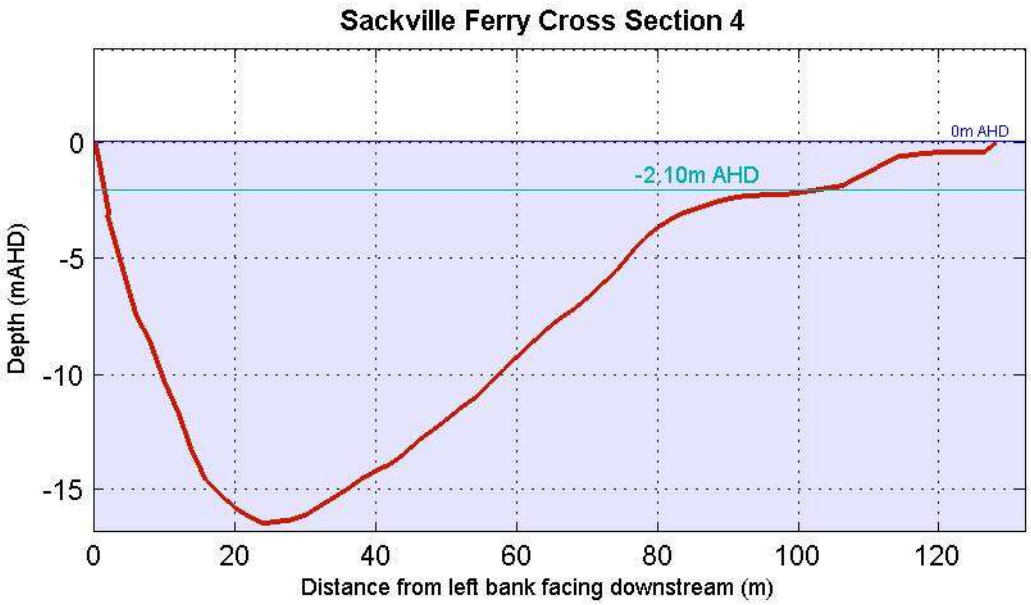
APPENDIX I: CROSS SECTIONS SHOWING CURRENT NAVIGABILITY

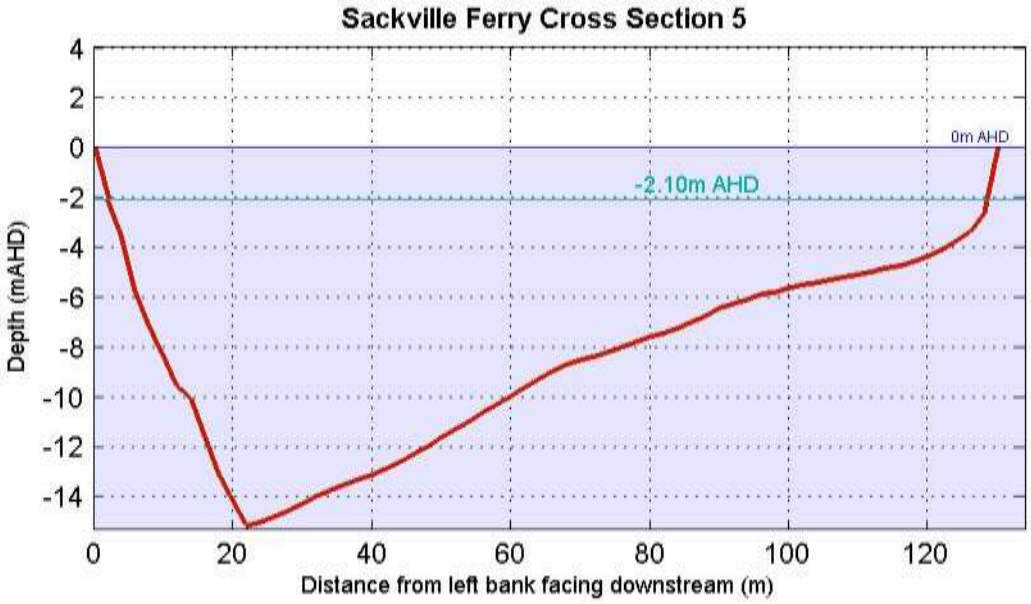
Sackville Ferry

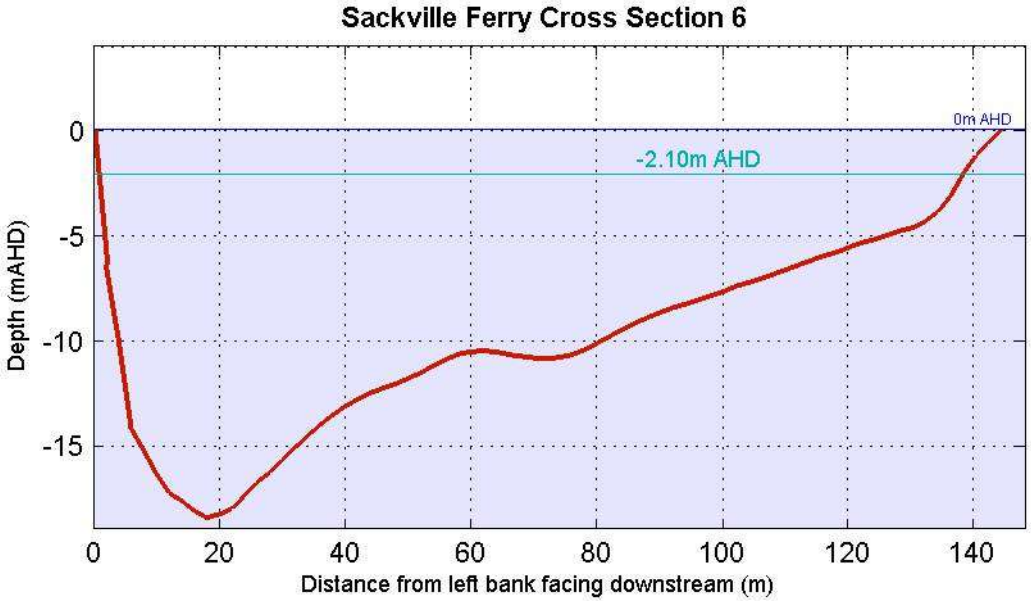




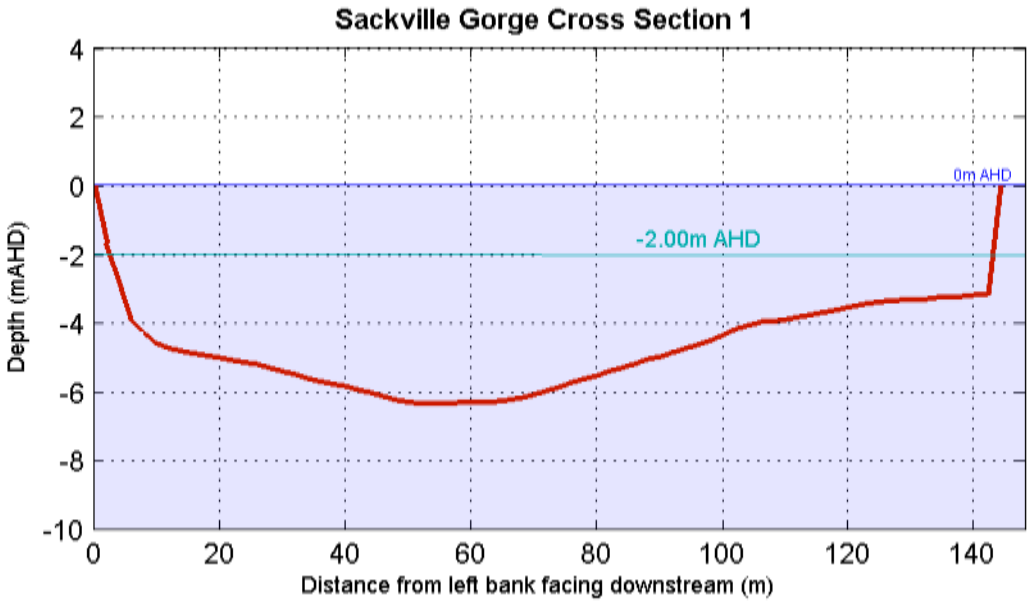

Sackville Ferry Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.10m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
140
160
180

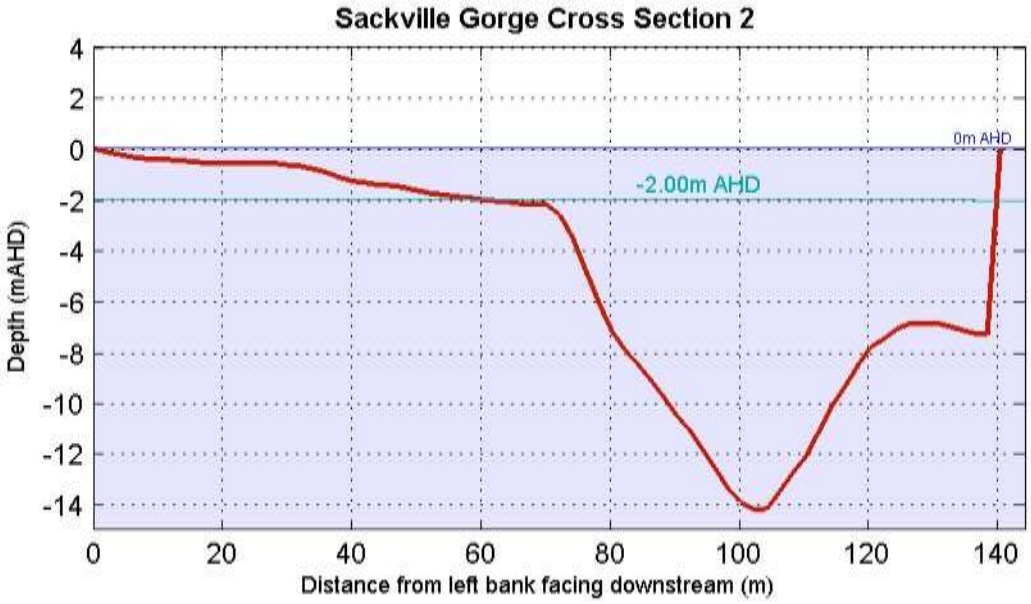

Sackville Ferry Cross Section 4
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.10m AHD
0
-5
-10
-15
0
20
40
60
80
100
120

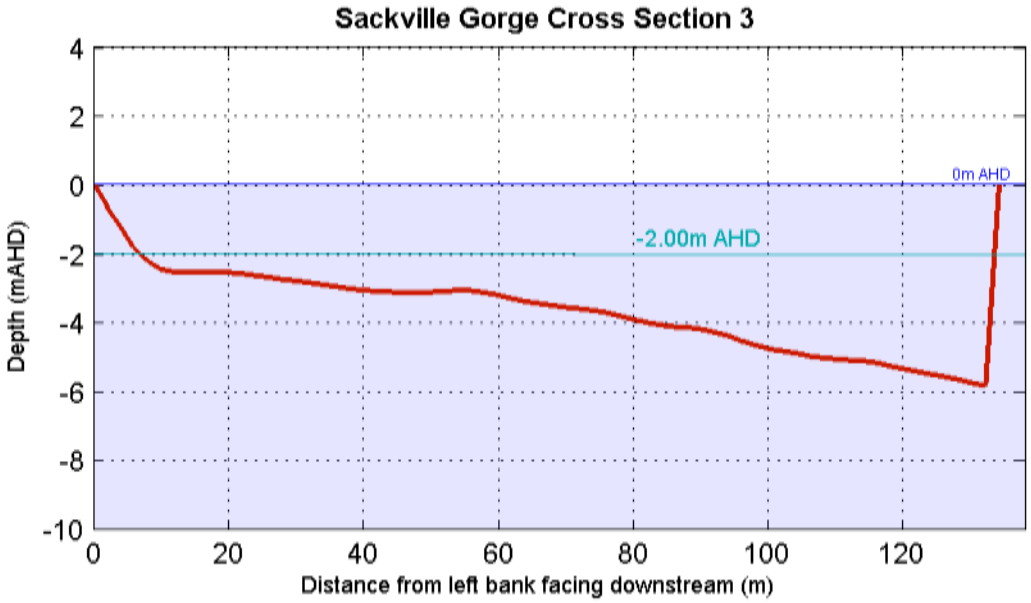

Sackville Ferry Cross Section 5
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.10m AHD
4
2
0
-2
-4
-6
-8
-10
-12
-14
0
20
40
60
80
100
120


Sackville Ferry Cross Section 6
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.10m AHD
0
-5
-10
-15
0
20
40
60
80
100
120
140

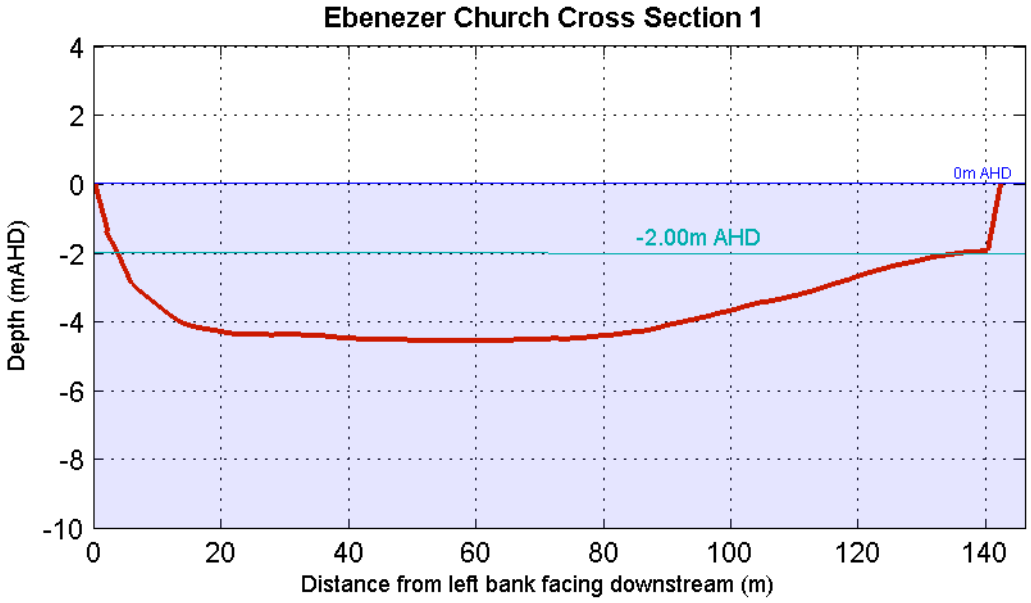
Sackville Gorge

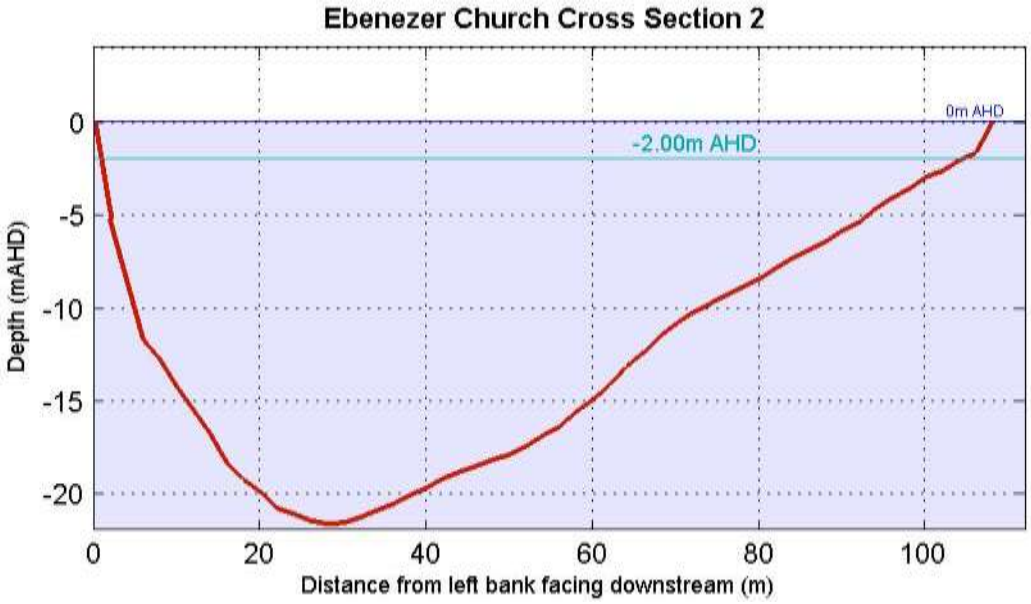


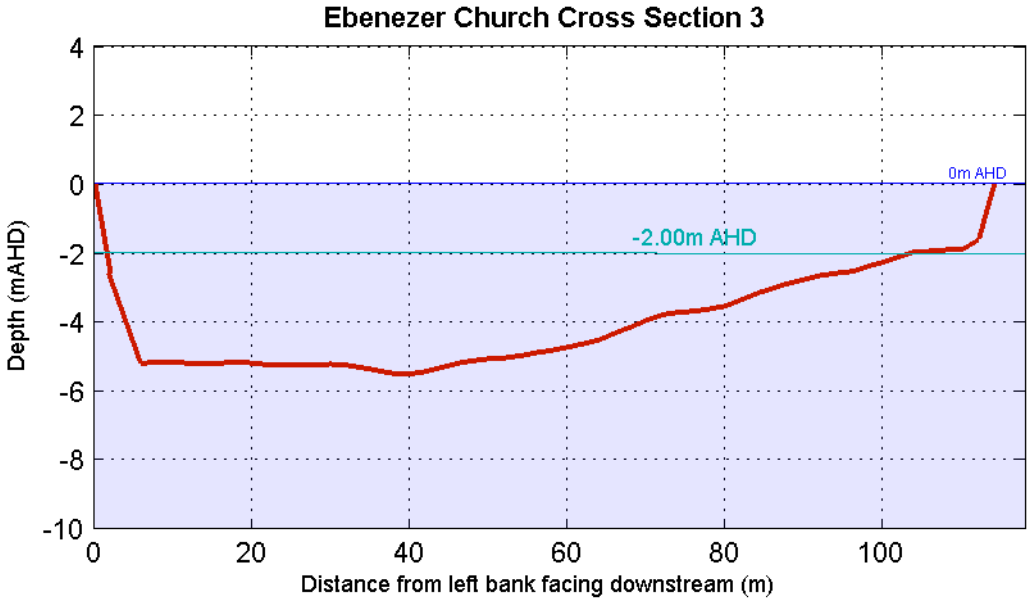




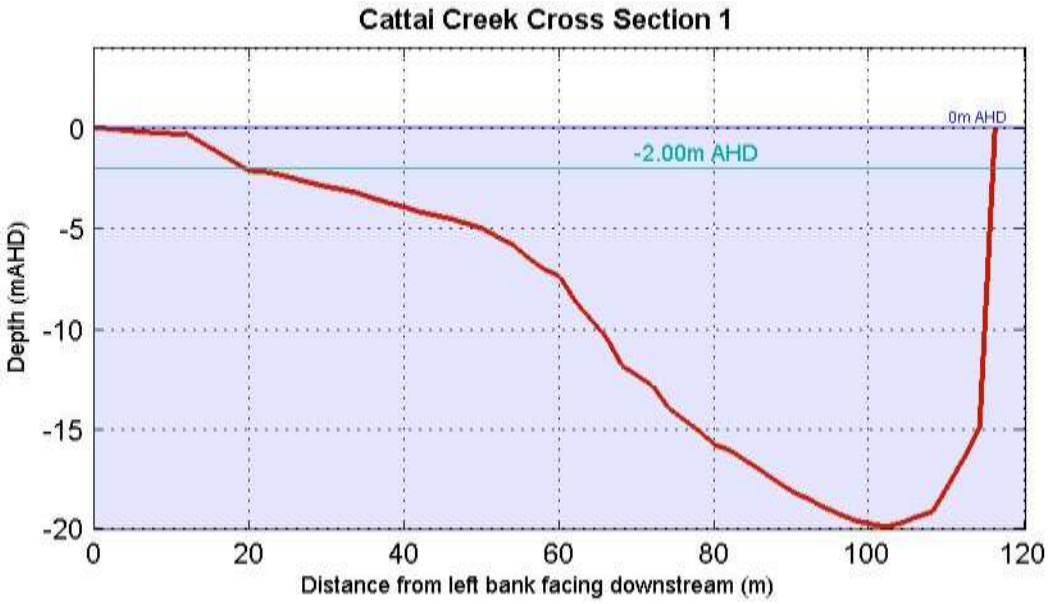
Ebenezer Church

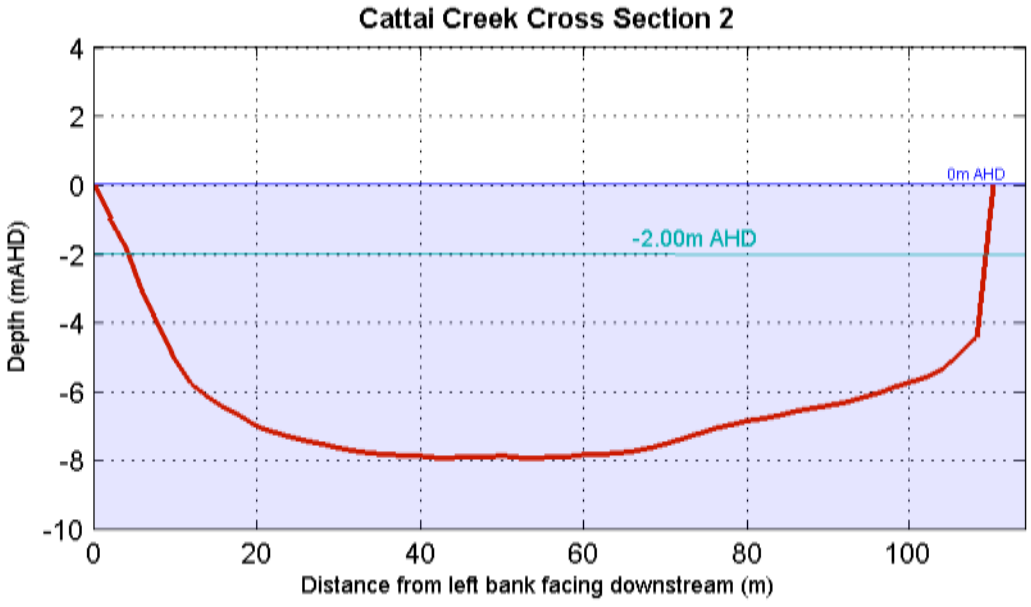


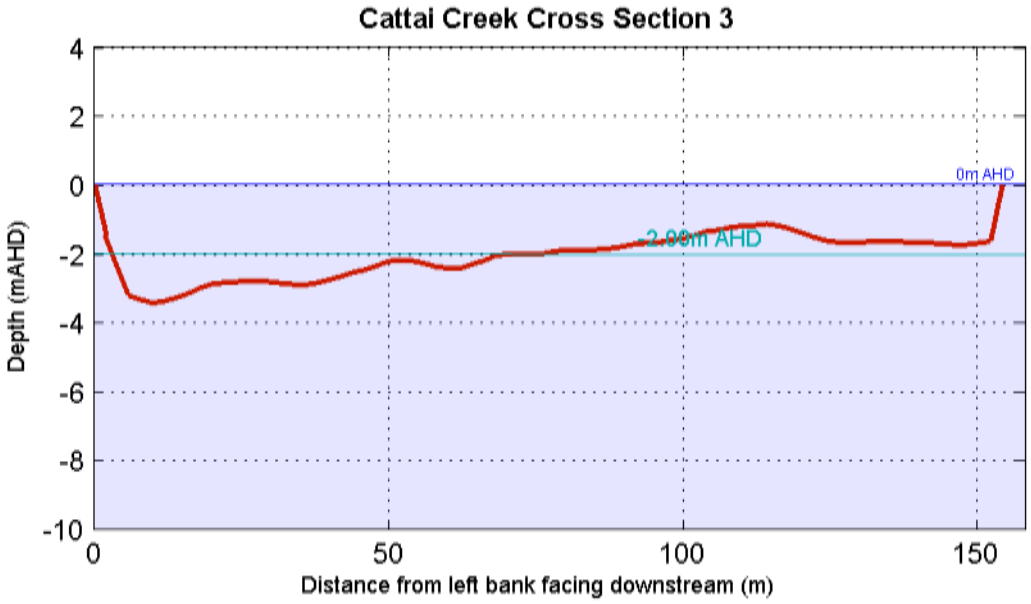

Ebenezer Church Cross Section 2
0m AHD
-2.00m AHD
Depth (mAHD)
0
-5
-10
-15
-20
0
20
40
60
80
100
Distance from left bank facing downstream (m)


Ebenezer Church Cross Section 3
0m AHD
-2.00m AHD
Depth (mAHD)
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
Distance from left bank facing downstream (m)

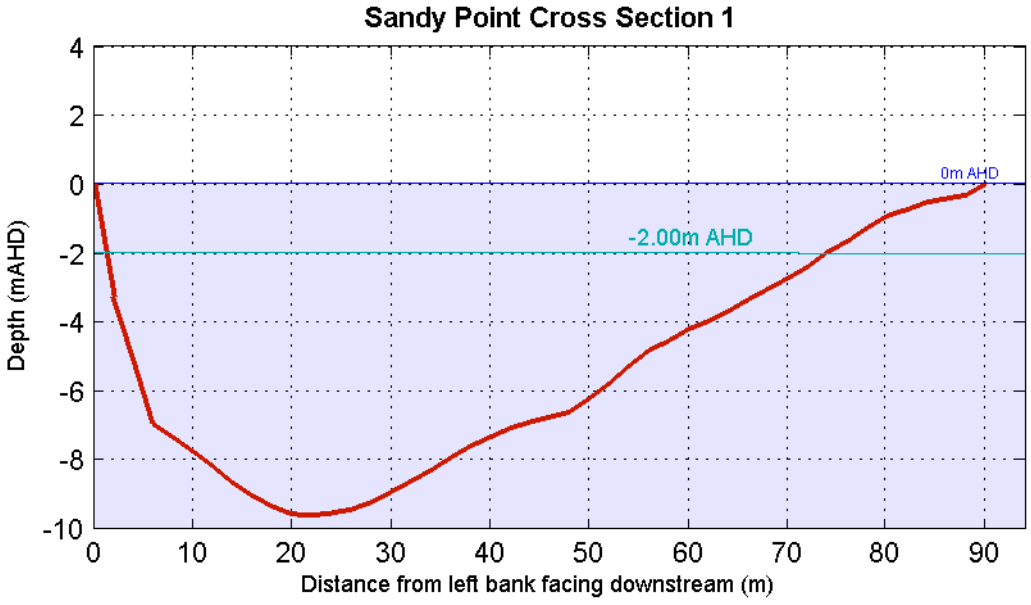
Cattai Creek

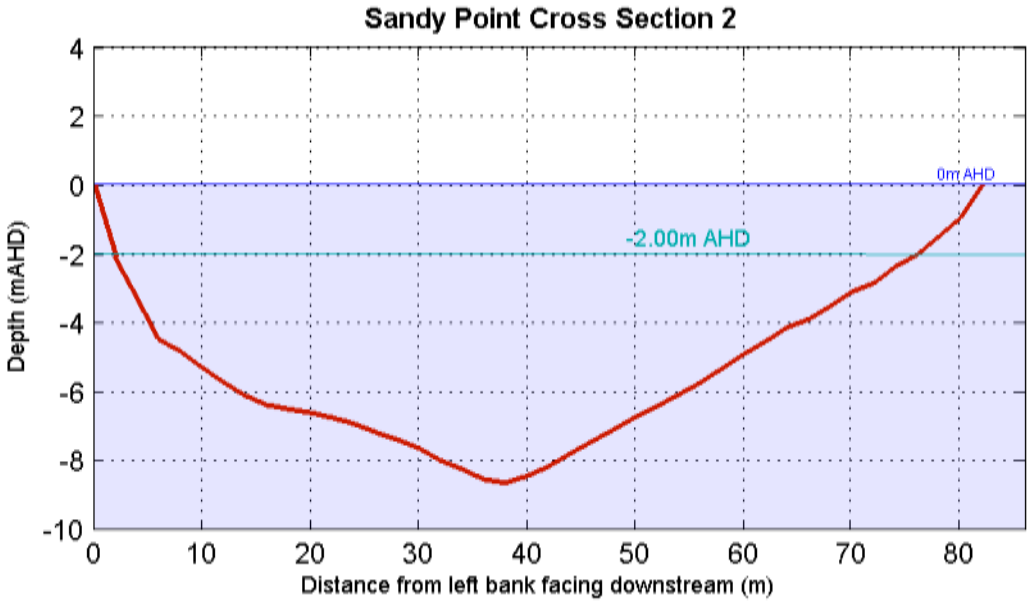


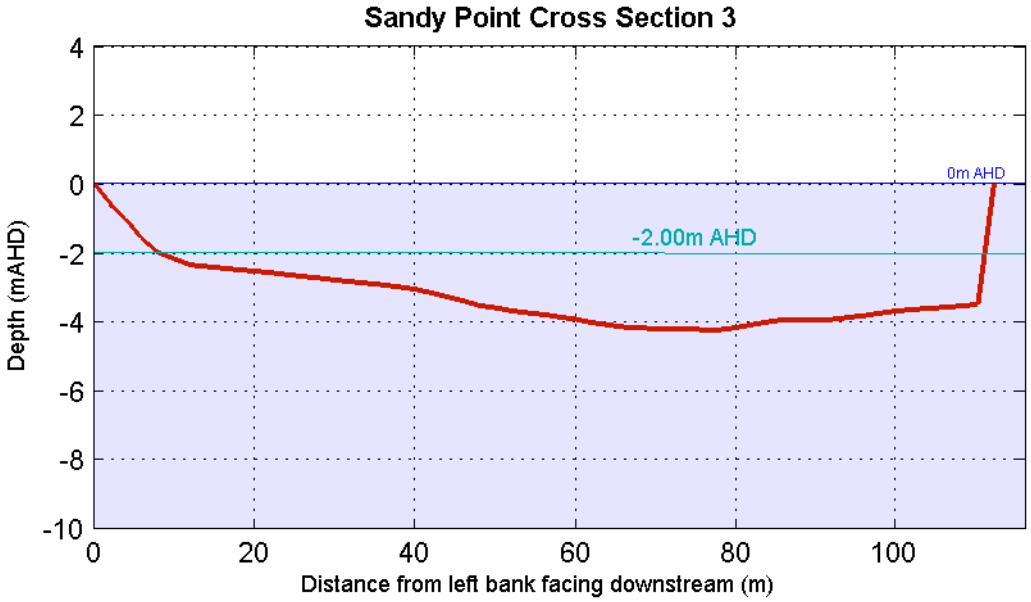



Cattai Creek Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
50
100
150

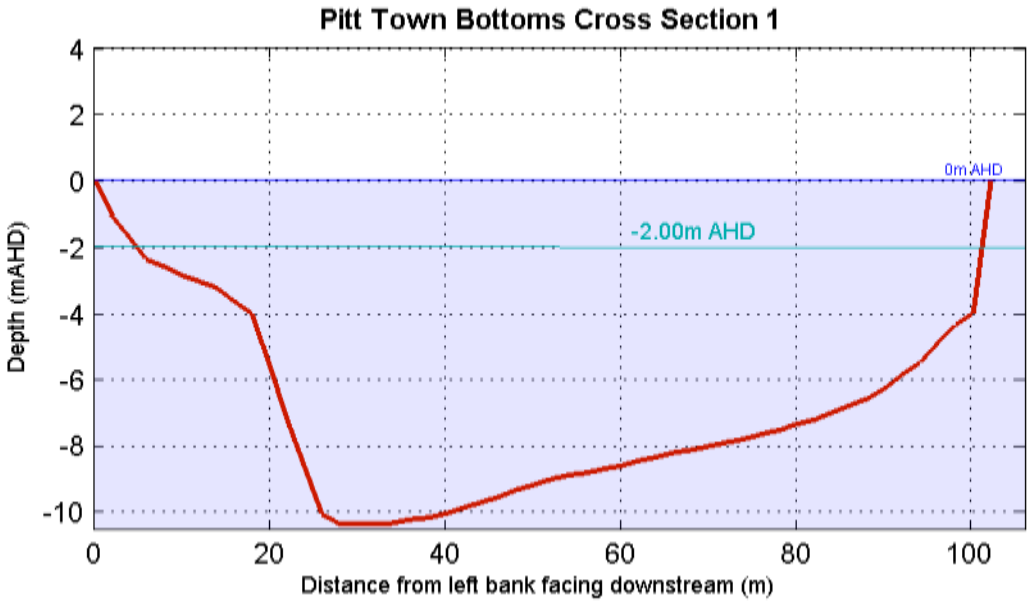
Sandy Point

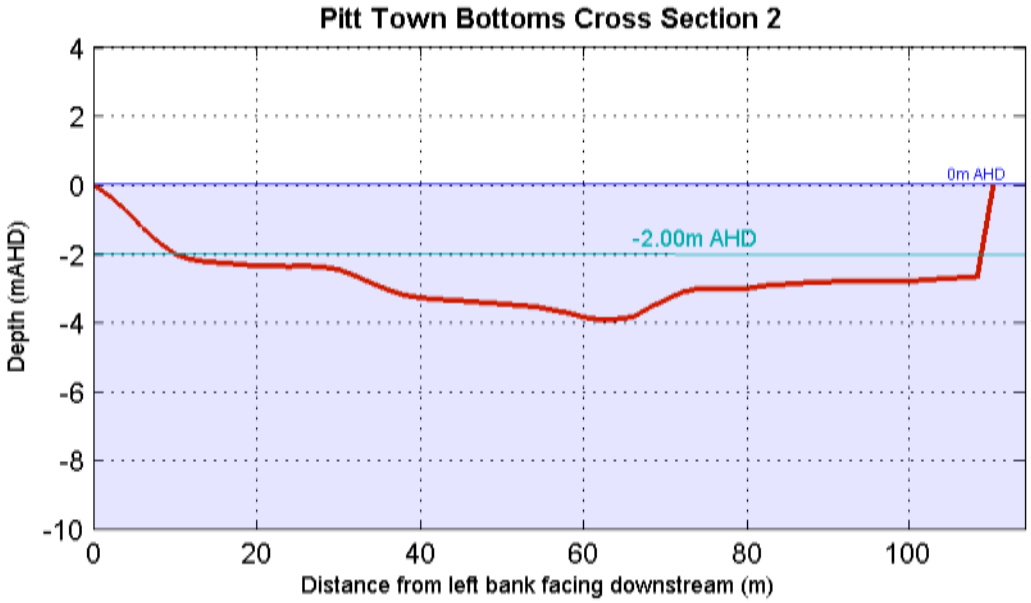

Sandy Point Cross Section 1
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60
70
80
90

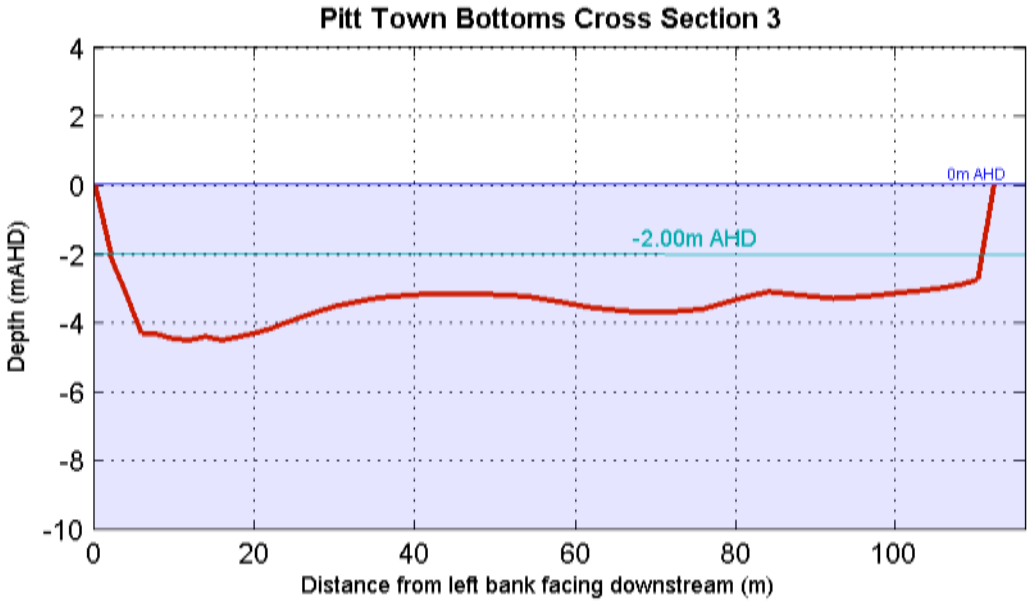

Sandy Point Cross Section 2
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60
70
80

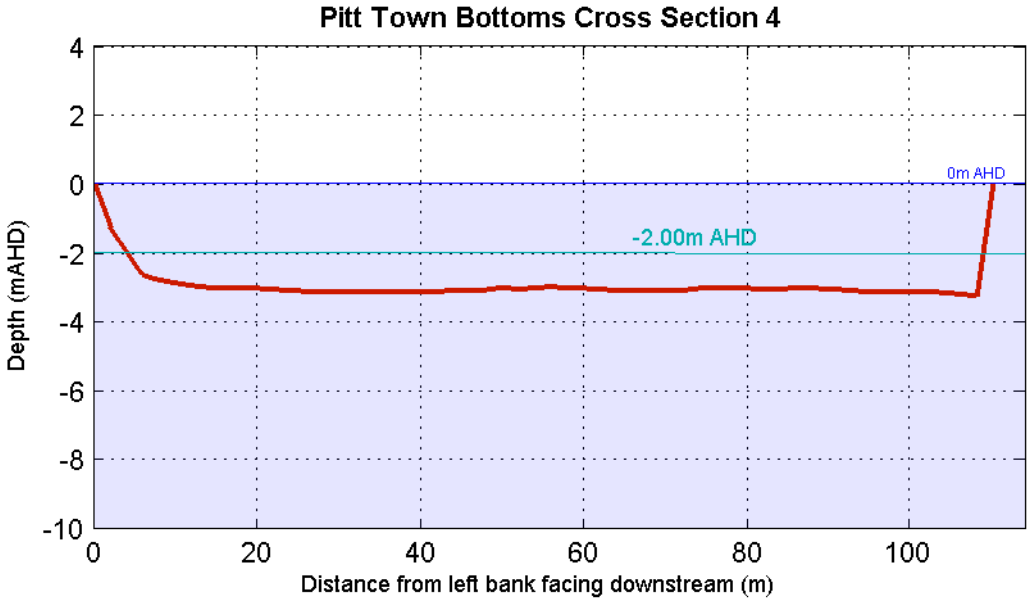

Sandy Point Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100

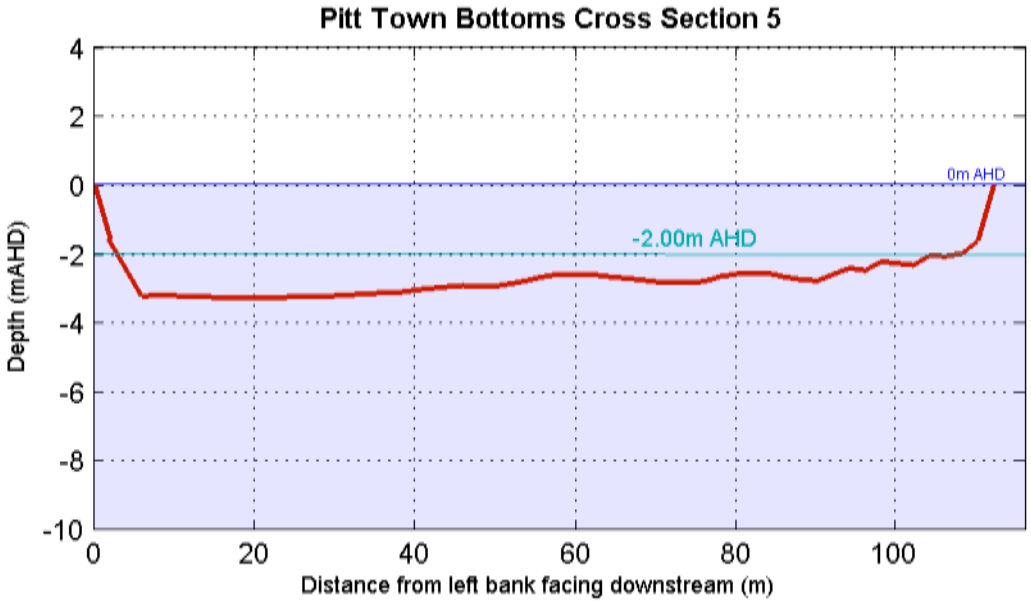
Pitt Town Bottoms



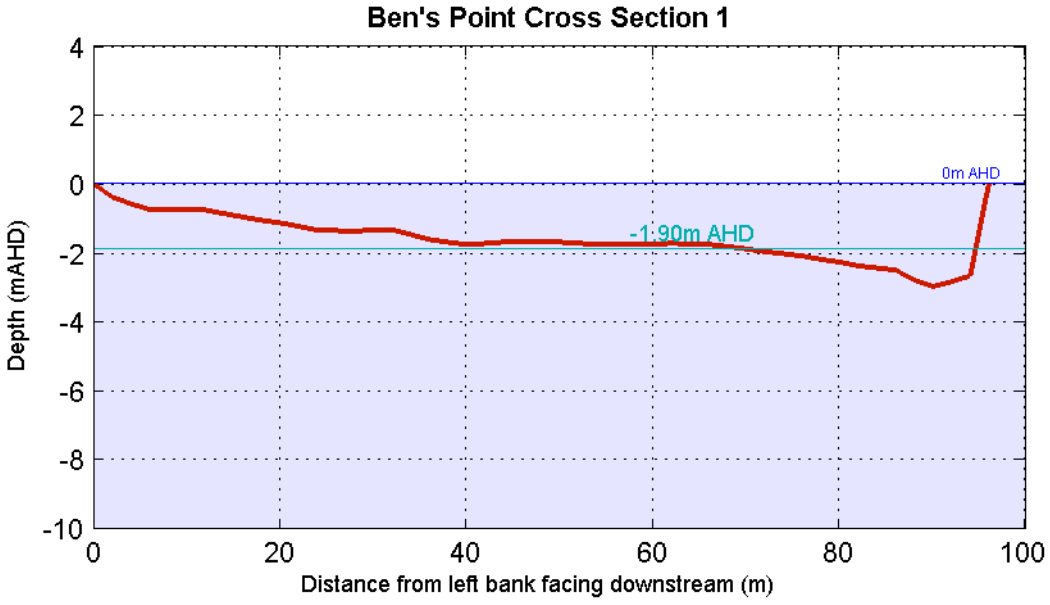


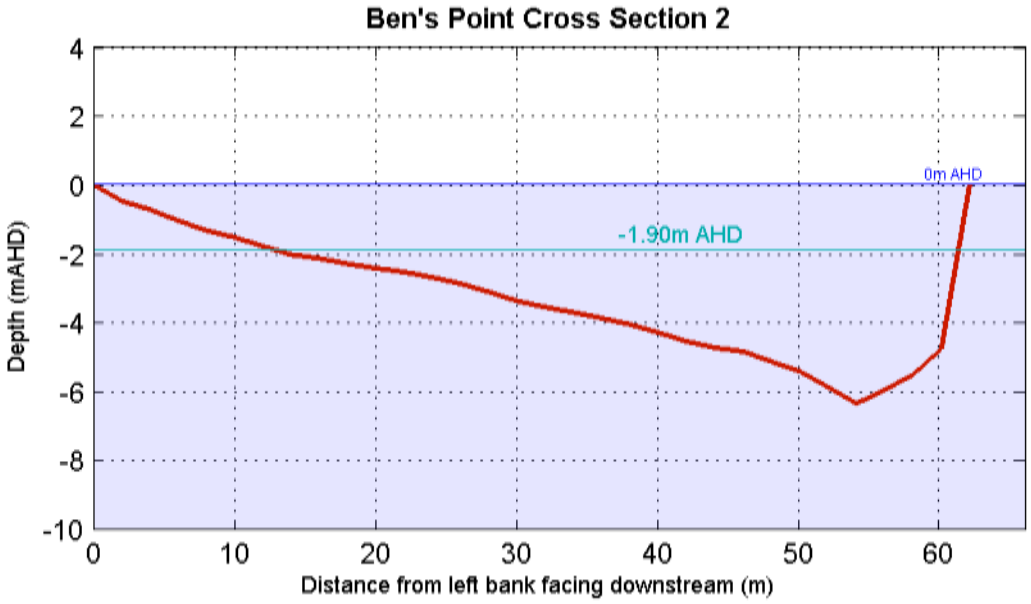

Pitt Town Bottoms Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100

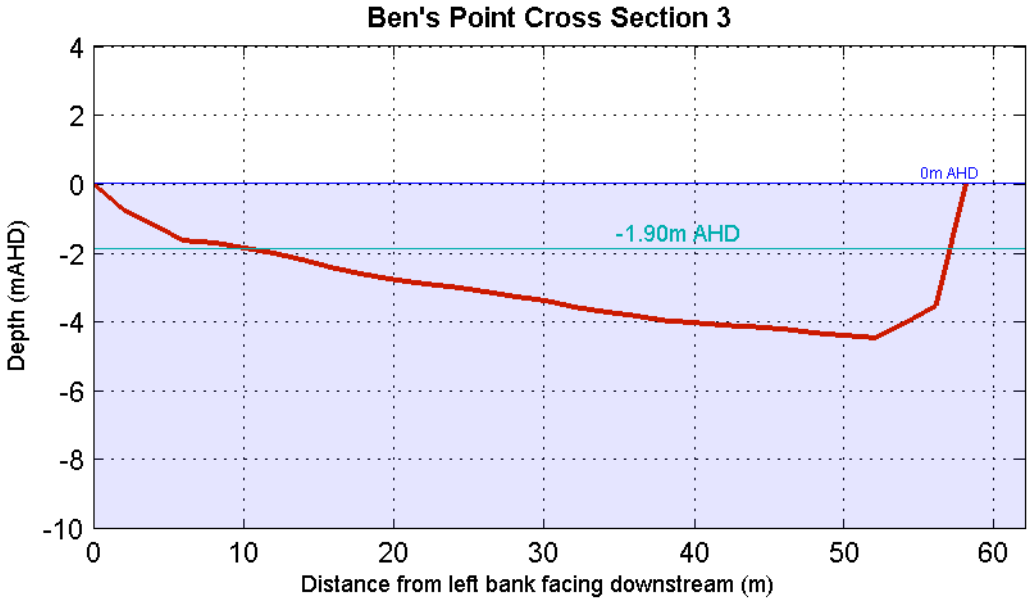

Pitt Town Bottoms Cross Section 4
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100


Pitt Town Bottoms Cross Section 5
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-2.00m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100

Bens Point

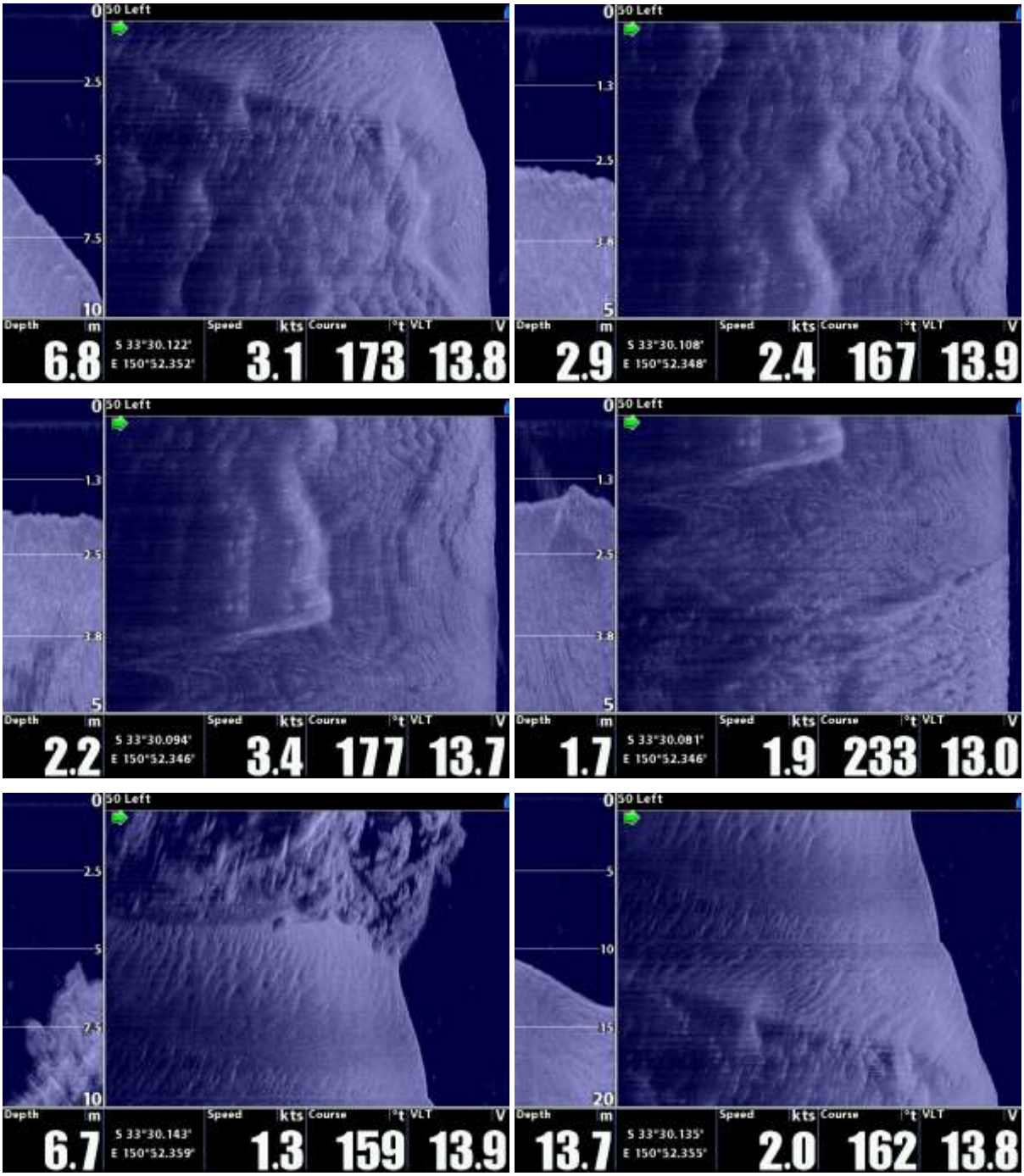

Ben's Point Cross Section 1
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-1.90m AHD
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100

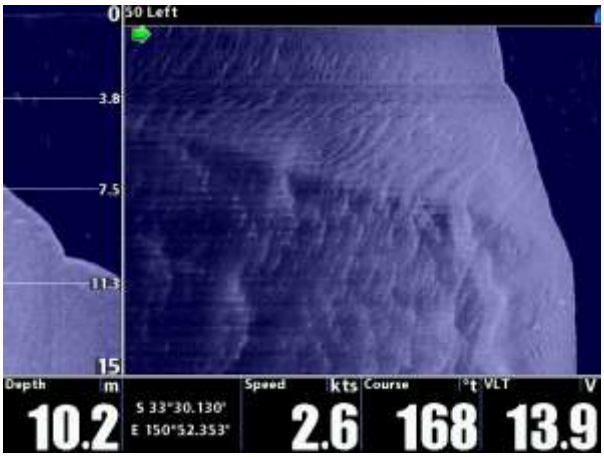

Ben's Point Cross Section 2
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-1.90m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60


Ben's Point Cross Section 3
Depth (mAHD)
Distance from left bank facing downstream (m)
0m AHD
-1.90m AHD
4
2
0
-2
-4
-6
-8
-10
0
10
20
30
40
50
60

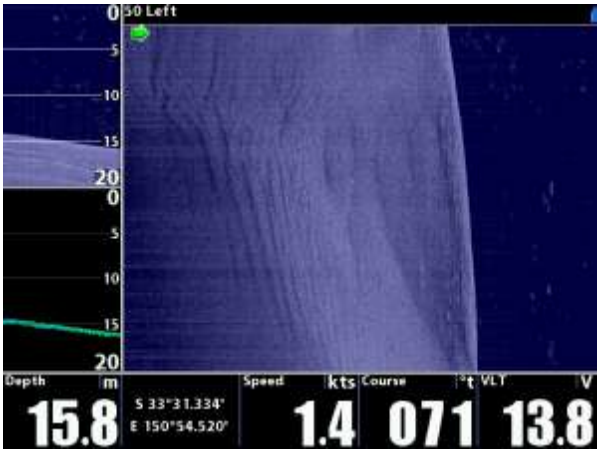
APPENDIX J: NSW ROADS AND MARITIME SERVICES SOUNDINGS

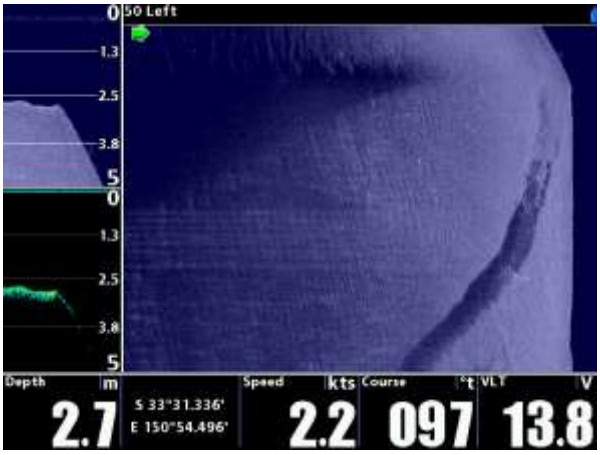
Sackville Ferry

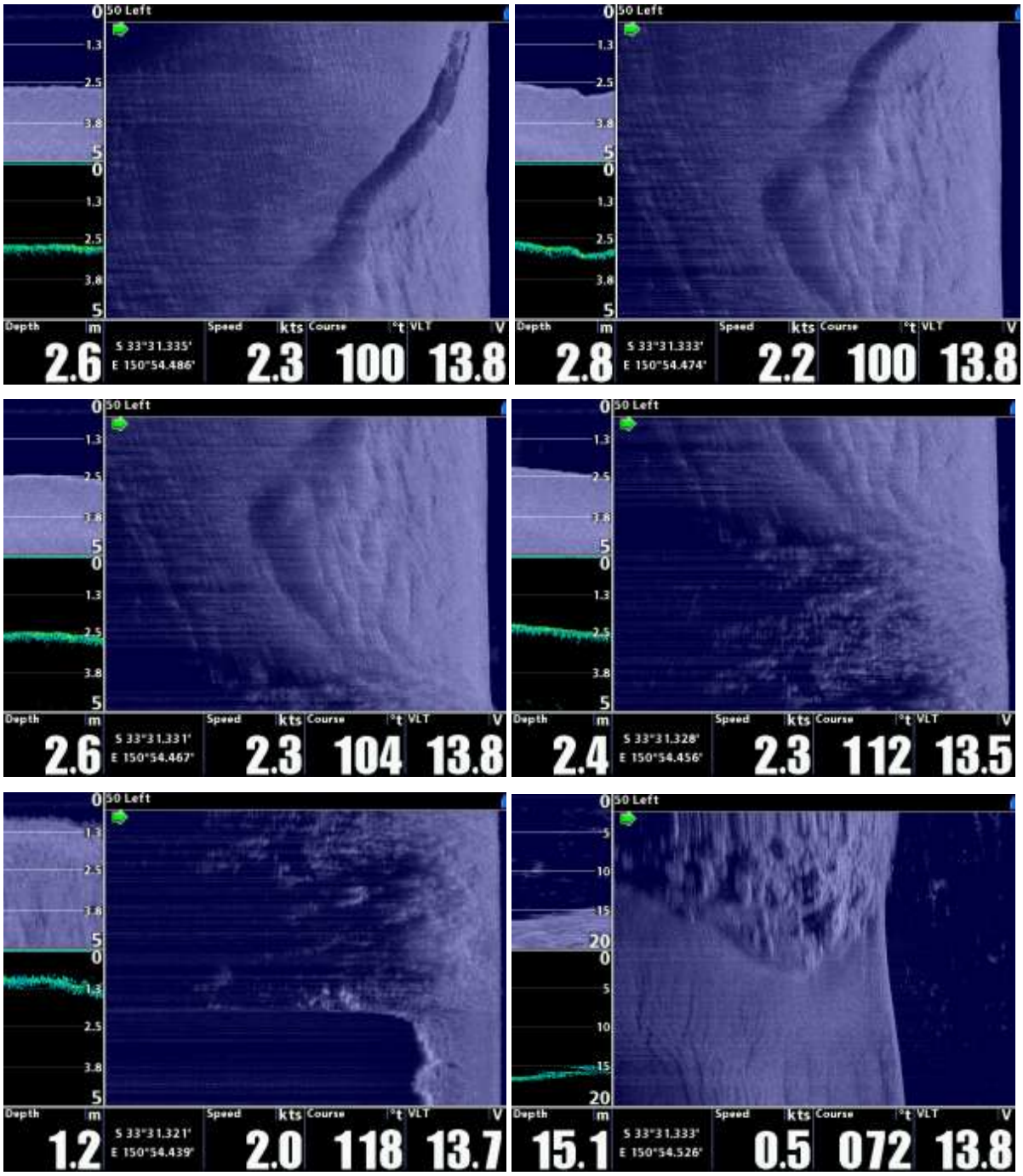




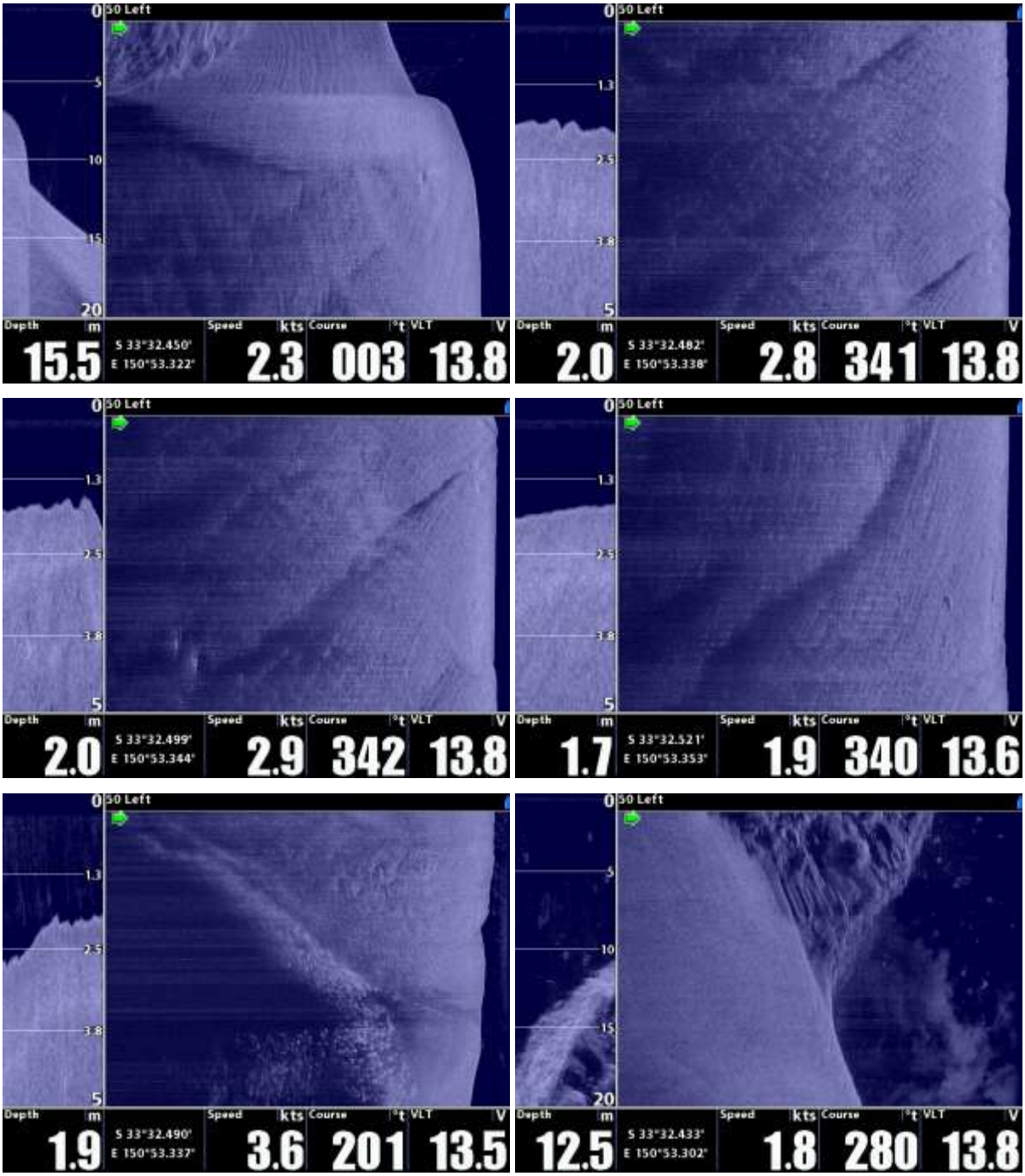
Sackville Gorge

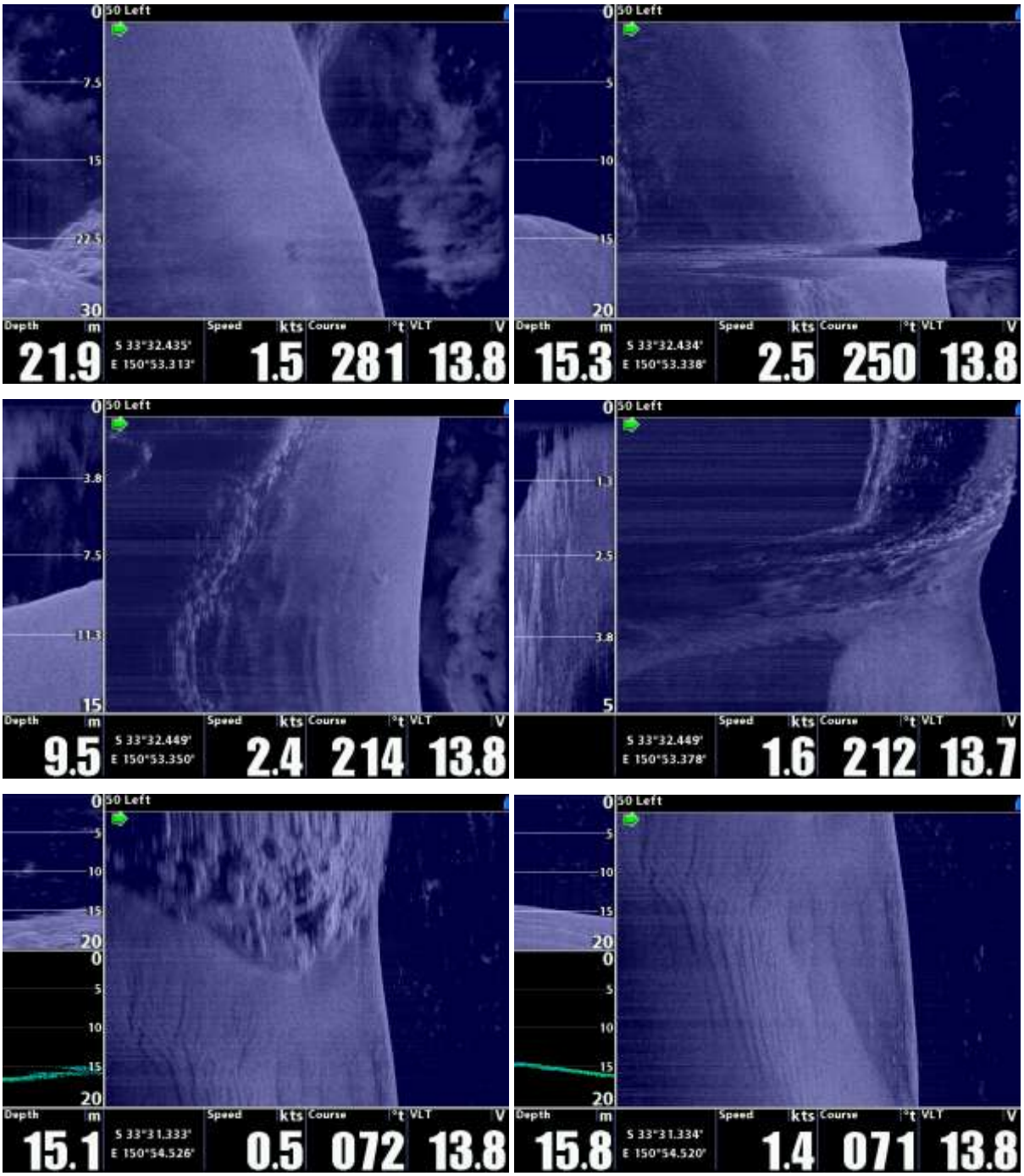


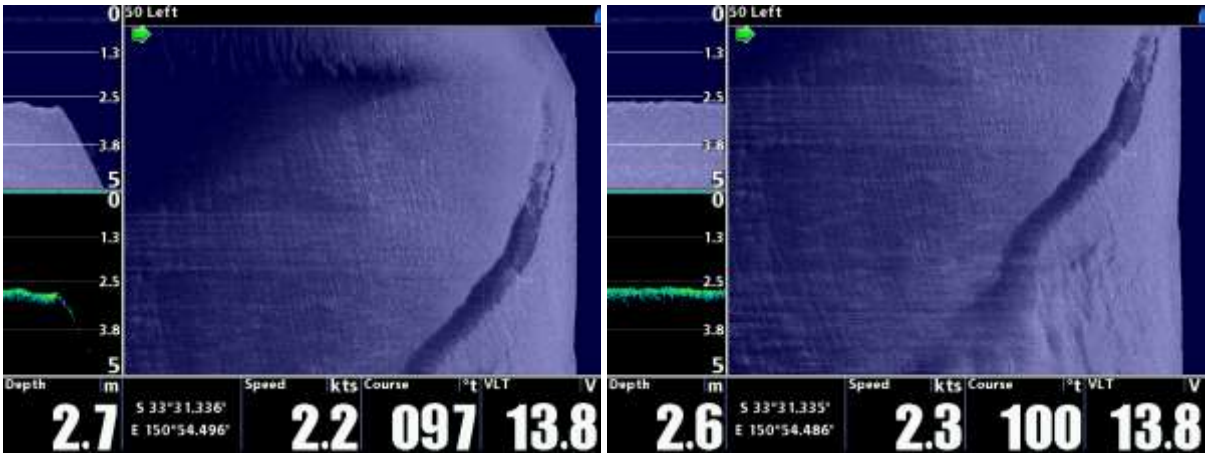


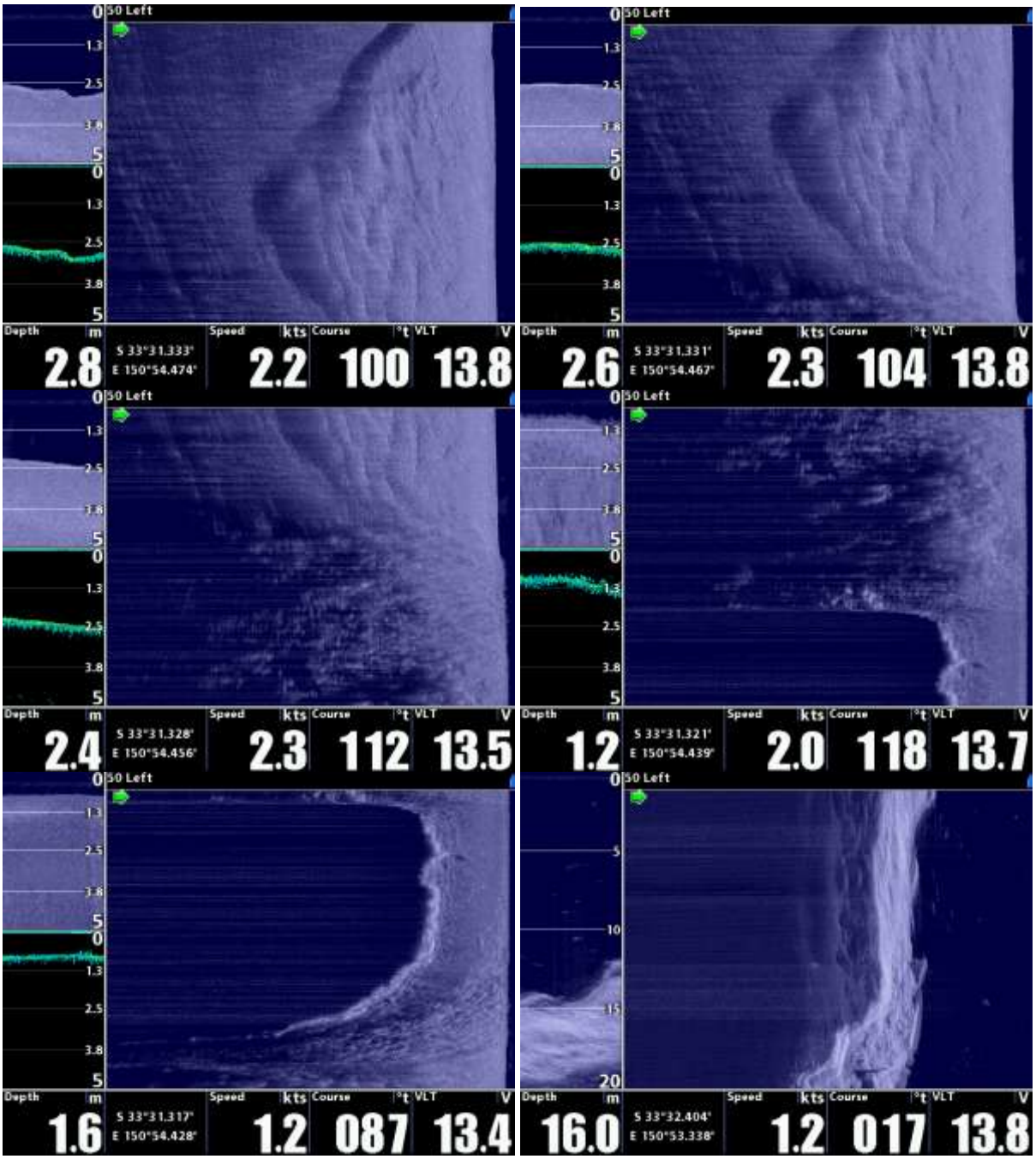

50 Left
Depth m 2.6
S 33°31.335'
E 150°54.486'
Speed kts 2.3
Course °t 100
VLT V 13.8
50 Left
Depth m 2.8
S 33°31.333'
E 150°54.474'
Speed kts 2.2
Course °t 100
VLT V 13.8
50 Left
Depth m 2.6
S 33°31.331'
E 150°54.467'
Speed kts 2.3
Course °t 104
VLT V 13.8
50 Left
Depth m 2.4
S 33°31.328'
E 150°54.456'
Speed kts 2.3
Course °t 112
VLT V 13.5
50 Left
Depth m 1.2
S 33°31.321'
E 150°54.439'
Speed kts 2.0
Course °t 118
VLT V 13.7
50 Left
Depth m 15.1
S 33°31.333'
E 150°54.526'
Speed kts 0.5
Course °t 072
VLT V 13.8

Ebenezer Church

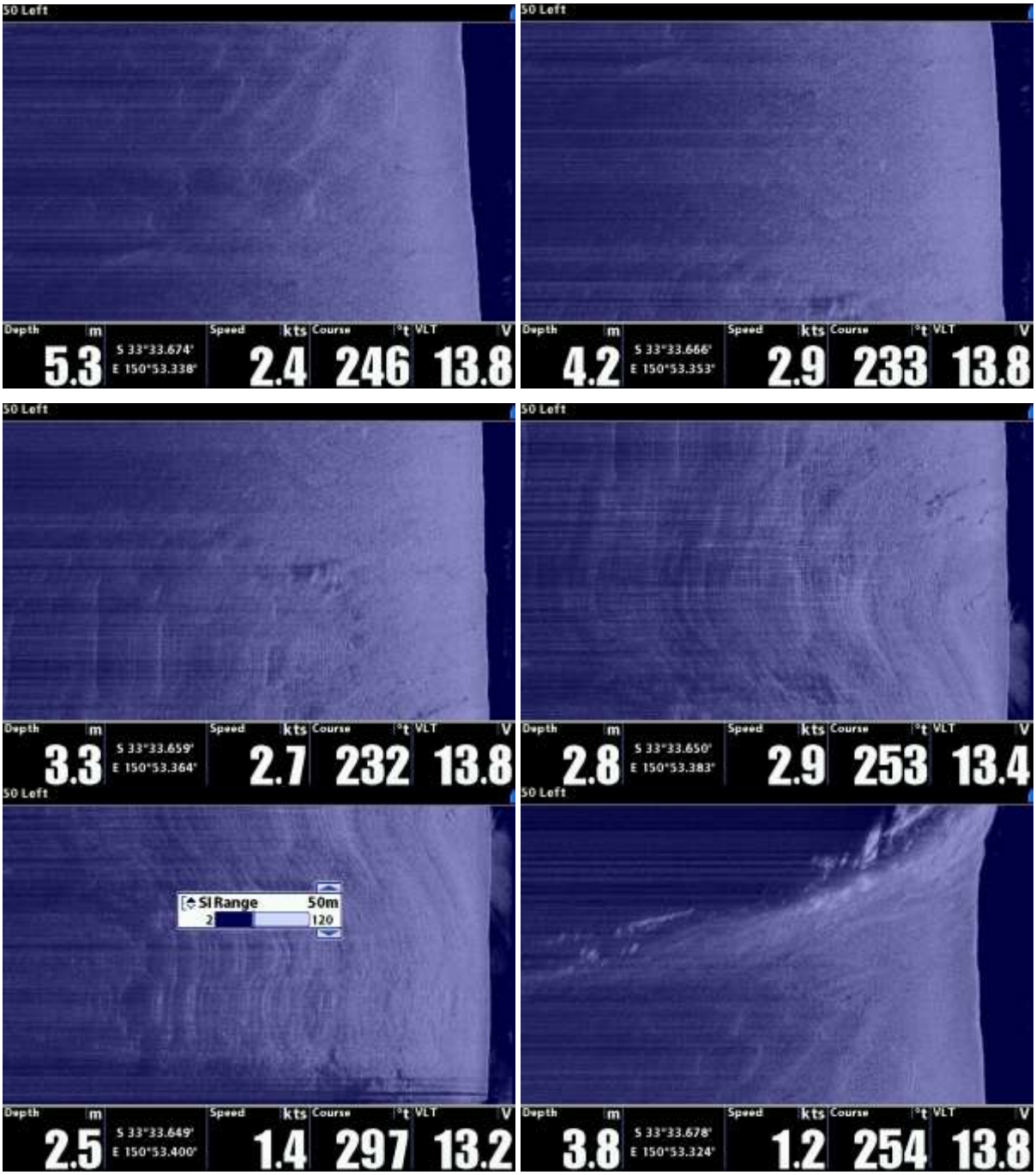



50 Left
Depth m 21.9
S 33°32.435'
E 150°53.313'
Speed kts 1.5
Course °t 281
VLT V 13.8
50 Left
Depth m 15.3
S 33°32.434'
E 150°53.338'
Speed kts 2.5
Course °t 250
VLT V 13.8
50 Left
Depth m 9.5
S 33°32.449'
E 150°53.350'
Speed kts 2.4
Course °t 214
VLT V 13.8
50 Left
Depth m
S 33°32.449'
E 150°53.378'
Speed kts 1.6
Course °t 212
VLT V 13.7
50 Left
Depth m 15.1
S 33°31.333'
E 150°54.526'
Speed kts 0.5
Course °t 072
VLT V 13.8
50 Left
Depth m 15.8
S 33°31.334'
E 150°54.520'
Speed kts 1.4
Course °t 071
VLT V 13.8

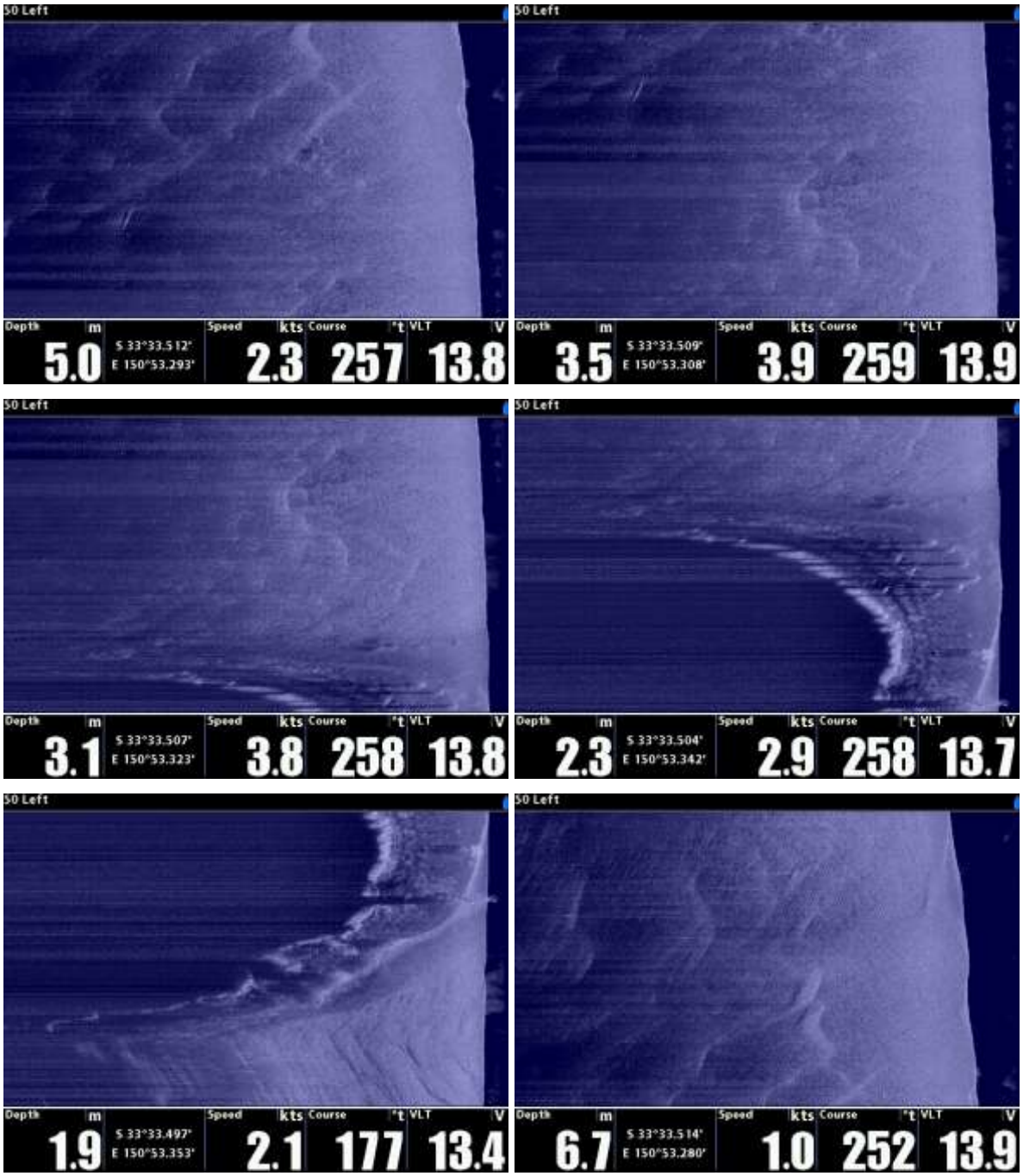

50 Left
Depth m
2.7
S 33°31.336'
E 150°54.496'
Speed kts
2.2
Course °t
097
VLT V
13.8
50 Left
Depth m
2.6
S 33°31.335'
E 150°54.486'
Speed kts
2.3
Course °t
100
VLT V
13.8


50 Left
Depth m 2.8
S 33°31.333'
E 150°54.474'
Speed kts 2.2
Course °t 100
VLT V 13.8
50 Left
Depth m 2.6
S 33°31.331'
E 150°54.467'
Speed kts 2.3
Course °t 104
VLT V 13.8
50 Left
Depth m 2.4
S 33°31.328'
E 150°54.456'
Speed kts 2.3
Course °t 112
VLT V 13.5
50 Left
Depth m 1.2
S 33°31.321'
E 150°54.439'
Speed kts 2.0
Course °t 118
VLT V 13.7
50 Left
Depth m 1.6
S 33°31.317'
E 150°54.428'
Speed kts 1.2
Course °t 087
VLT V 13.4
50 Left
Depth m 16.0
S 33°32.404'
E 150°53.338'
Speed kts 1.2
Course °t 017
VLT V 13.8

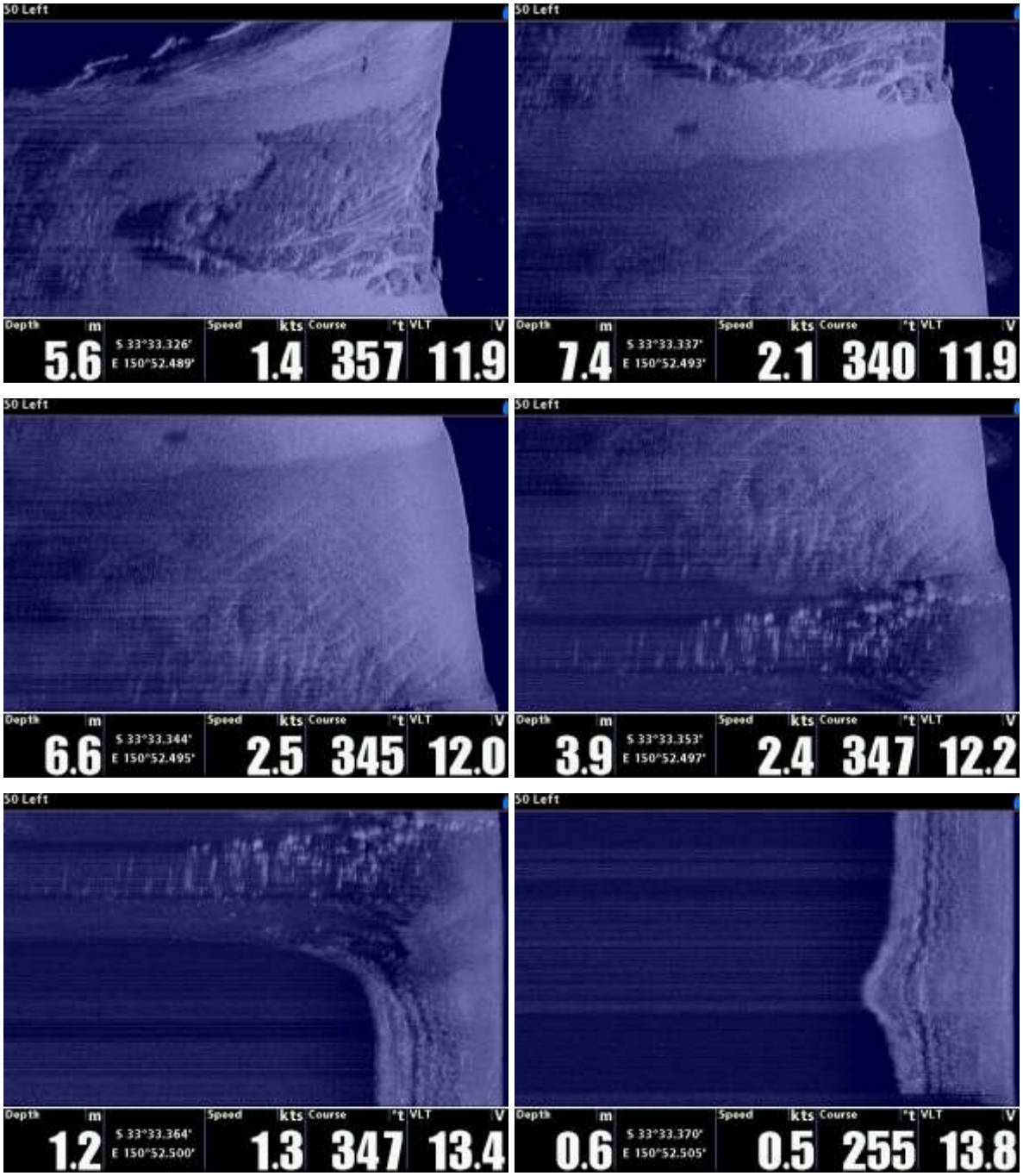
Cattai Creek 1

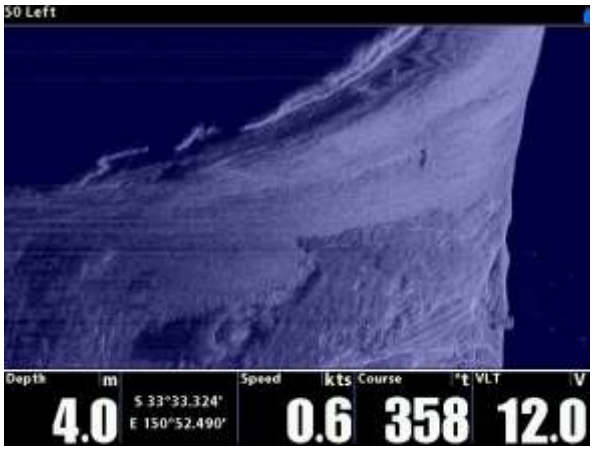


Cattai Creek 2

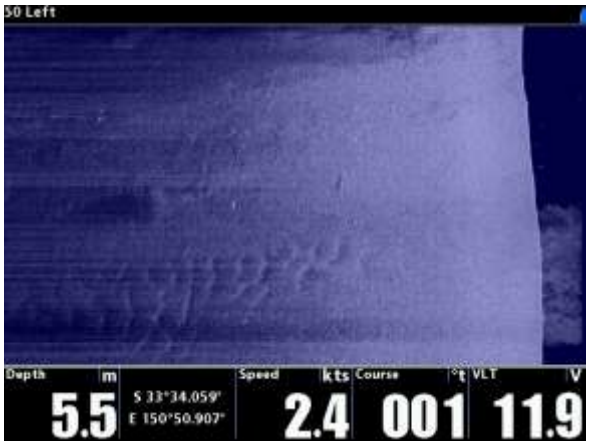


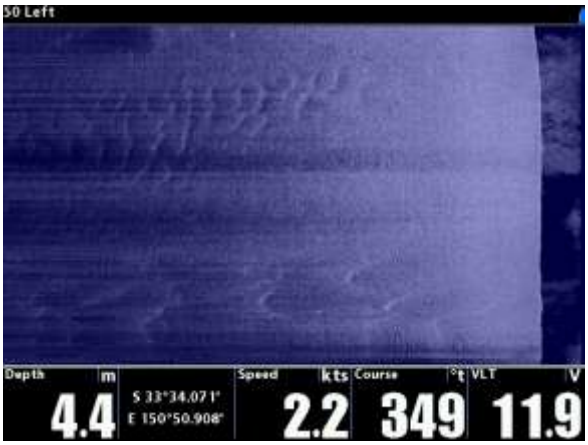
Sandy Point

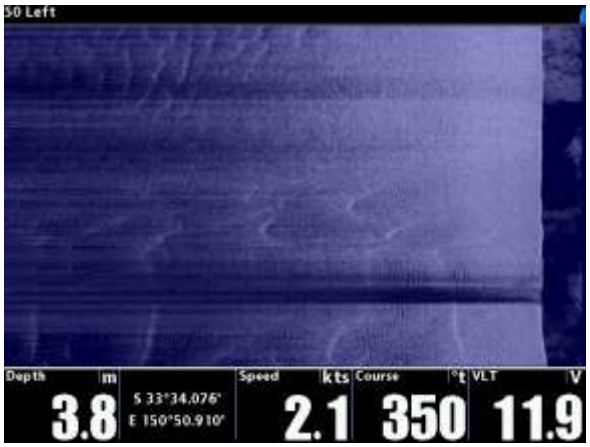

50 Left
Depth m 5.6 S 33°33.326' E 150°52.489' Speed kts 1.4 Course °t 357 VLT V 11.9
50 Left
Depth m 7.4 S 33°33.337' E 150°52.493' Speed kts 2.1 Course °t 340 VLT V 11.9
50 Left
Depth m 6.6 S 33°33.344' E 150°52.495' Speed kts 2.5 Course °t 345 VLT V 12.0
50 Left
Depth m 3.9 S 33°33.353' E 150°52.497' Speed kts 2.4 Course °t 347 VLT V 12.2
50 Left
Depth m 1.2 S 33°33.364' E 150°52.500' Speed kts 1.3 Course °t 347 VLT V 13.4
50 Left
Depth m 0.6 S 33°33.370' E 150°52.505' Speed kts 0.5 Course °t 255 VLT V 13.8

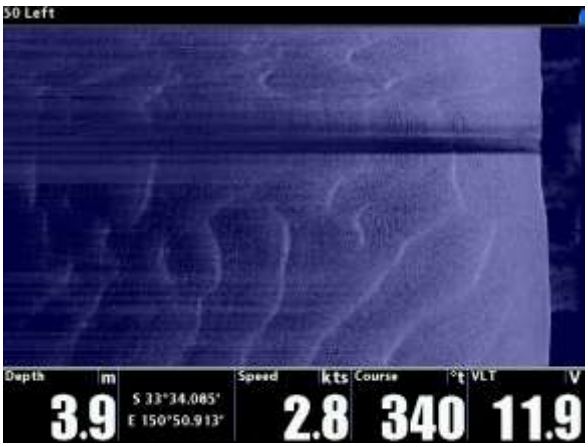


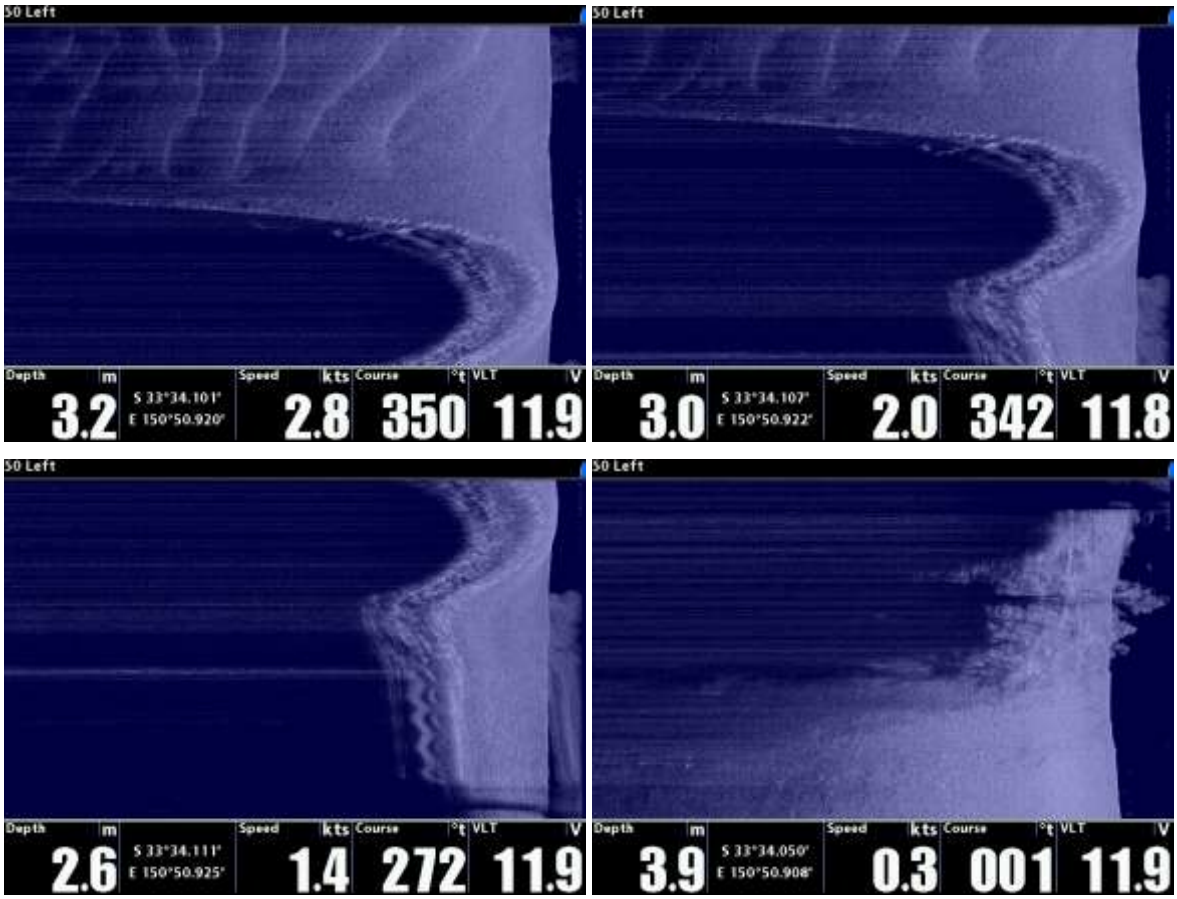
Pitt Town Bottoms



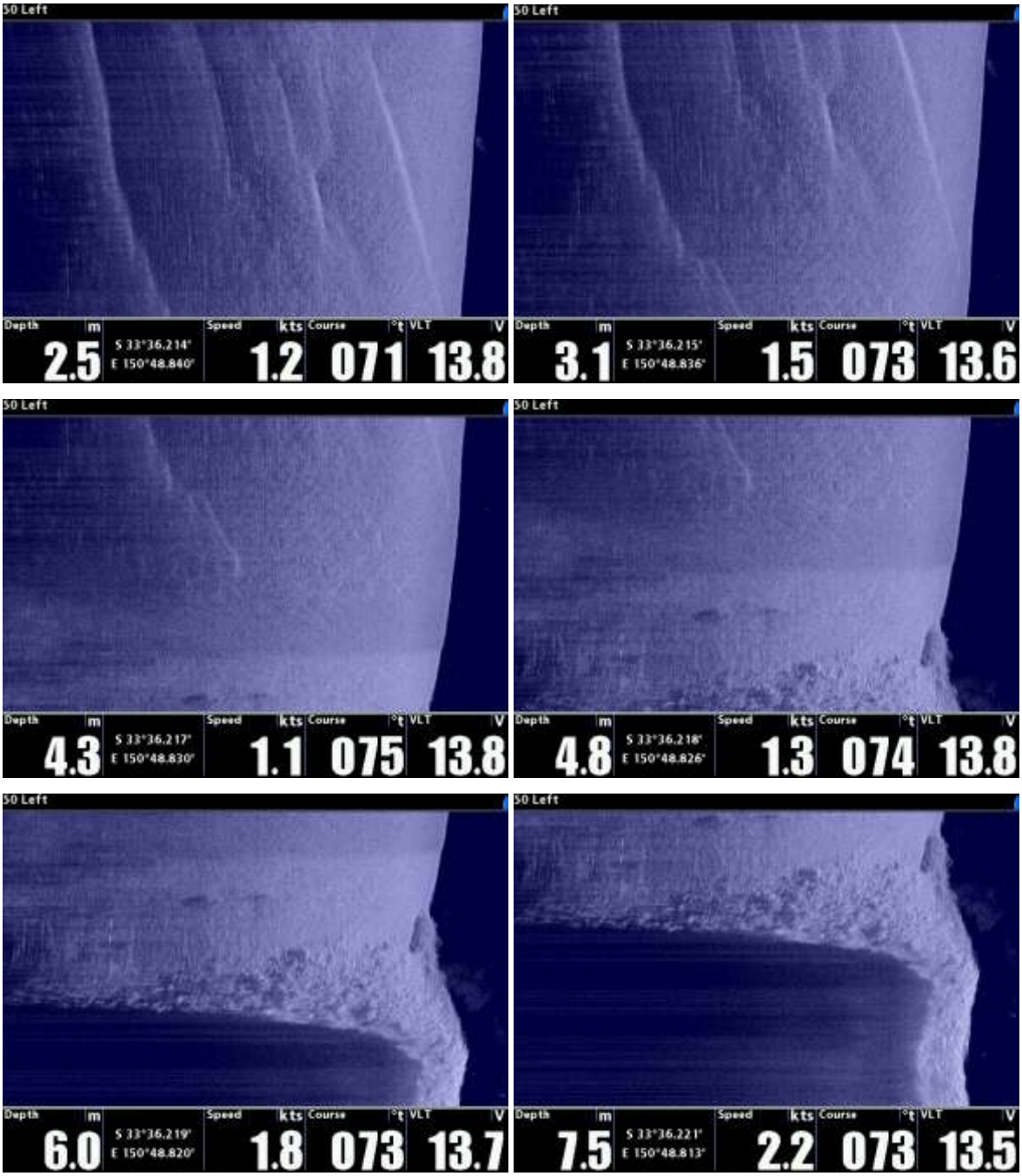


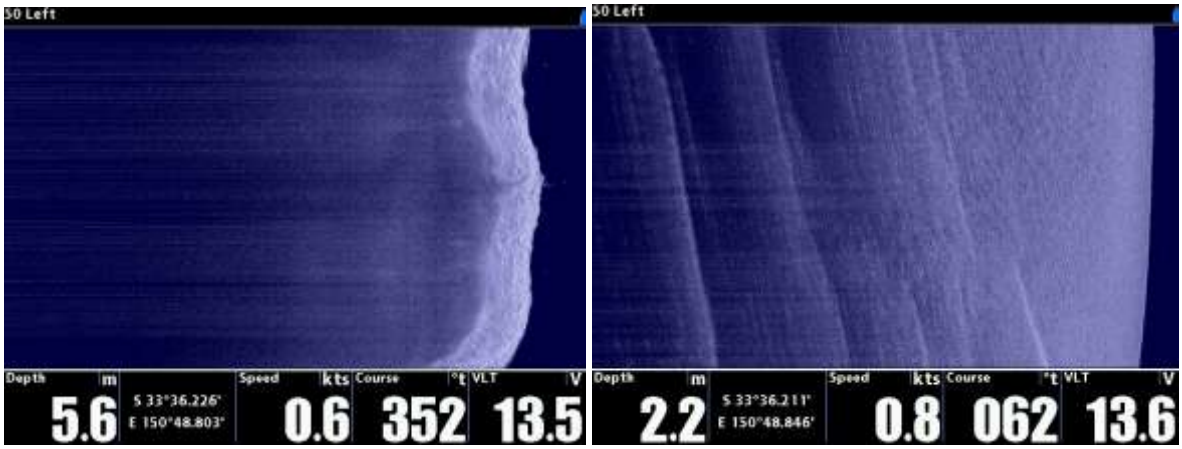





S0 Left
Depth m
3.2
S 33°34.101'
E 150°50.920'
Speed kts
2.8
Course °t
350
VLT V
11.9
S0 Left
Depth m
3.0
S 33°34.107'
E 150°50.922'
Speed kts
2.0
Course °t
342
VLT V
11.8
S0 Left
Depth m
2.6
S 33°34.111'
E 150°50.925'
Speed kts
1.4
Course °t
272
VLT V
11.9
S0 Left
Depth m
3.9
S 33°34.050'
E 150°50.908'
Speed kts
0.3
Course °t
001
VLT V
11.9

Ben's Point


S0 Left
Depth m 2.5 S 33°36.214' E 150°48.840' Speed kts 1.2 Course °t 071 VLT V 13.8
S0 Left
Depth m 3.1 S 33°36.215' E 150°48.836' Speed kts 1.5 Course °t 073 VLT V 13.6
S0 Left
Depth m 4.3 S 33°36.217' E 150°48.830' Speed kts 1.1 Course °t 075 VLT V 13.8
S0 Left
Depth m 4.8 S 33°36.218' E 150°48.826' Speed kts 1.3 Course °t 074 VLT V 13.8
S0 Left
Depth m 6.0 S 33°36.219' E 150°48.820' Speed kts 1.8 Course °t 073 VLT V 13.7
S0 Left
Depth m 7.5 S 33°36.221' E 150°48.813' Speed kts 2.2 Course °t 073 VLT V 13.5


50 Left
Depth m
5.6
S 33°36.226'
E 150°48.803'
Speed kts
0.6
Course °t
352
VLT V
13.5
50 Left
Depth m
2.2
S 33°36.211'
E 150°48.846'
Speed kts
0.8
Course °t
062
VLT V
13.6

APPENDIX K: TIDAL PLANES (2009 TO 2010) PURCHASED FROM MANLY HYDRAULICS LABORATORY

Public Works
Manly Hydraulics Laboratory

110B King Street
Manly Vale NSW 2093
T 02 9949 0200 **F** 02 9948 6185 **TTY** 1300 301 181
ABN 81 913 830 179 www.mhl.nsw.gov.au

File No. DEC-0023

23 May 2012

Alexandra Bennett
Ports and Marine Terminals
Worley Parsons
Level 11, 141 Walker Street
PO Box 1812
North Sydney 2059

Dear Alexandra,

RE: Tidal Planes – Hawkesbury River

In accordance with the Surveyor General's Directions No. 6, Water as a Boundary Procedures March 2004 Version 5.5, Tidal Planes are defined for the following locations and period of record.

- Location: **Webbs Creek**, Hawkesbury River
- Geographic Co-ordinates: MGA Zone 56, 312346E, 6303935N
- Period of data analysed: 2009-2010
- The High High Water Solstices Springs is **1.238m** AHD +/- 0.05m
- The Mean High Water Springs is **0.906m** AHD +/- 0.05m
- The Mean High Water Mark is **0.775m** AHD +/- 0.05m
- The Mean High Water Neaps is **0.644m** AHD +/- 0.05m
- The Mean Sea Level is **0.168m** AHD +/- 0.05m
- The Mean Low Water Neaps is **-0.308m** AHD +/- 0.05m
- The Mean Low Water is **-0.439m** AHD +/- 0.05m
- The Mean Low Water Springs is **-0.570m** +/- 0.05m
- The Indian Spring Low Water is -**0.806m** AHD +/- 0.05m

- Location: **Colo Junction**, Hawkesbury River
- Geographic Co-ordinates: MGA Zone 56, 303218E, 6298170N
- Period of data analysed: 2009-2010
- The High High Water Solstices Springs is **1.296m** AHD +/- 0.05m
- The Mean High Water Springs is **0.973m** AHD +/- 0.05m
- The Mean High Water Mark is **0.863m** AHD +/- 0.05m
- The Mean High Water Neaps is **0.753m** AHD +/- 0.05m
- The Mean Sea Level is **0.290m** AHD +/- 0.05m
- The Mean Low Water Neaps is **-0.174m** AHD +/- 0.05m
- The Mean Low Water is **-0.284m** AHD +/- 0.05m
- The Mean Low Water Springs is **-0.394m** +/- 0.05m
- The Indian Spring Low Water is **-0.625m** AHD +/- 0.05m

- Location: **Sackville**, Hawkesbury River
- Geographic Co-ordinates: MGA Zone 56, 303238E, 6292029N
- Period of data analysed: 2009-2010
- The High High Water Solstices Springs is **1.136m** AHD +/- 0.05m
- The Mean High Water Springs is **0.858m** AHD +/- 0.05m
- The Mean High Water Mark is **0.767m** AHD +/- 0.05m
- The Mean High Water Neaps is **0.676m** AHD +/- 0.05m
- The Mean Sea Level is **0.287m** AHD +/- 0.05m
- The Mean Low Water Neaps is **-0.103m** AHD +/- 0.05m
- The Mean Low Water is **-0.193m** AHD +/- 0.05m
- The Mean Low Water Springs is **-0.284m** +/- 0.05m
- The Indian Spring Low Water is **-0.482m** AHD +/- 0.05m

- Location: **Ebenezer**, Hawkesbury River
- Geographic Co-ordinates: MGA Zone 56, 304385E, 6286031N
- Period of data analysed: 2009-2010
- The High High Water Solstices Springs is **0.942m** AHD +/- 0.05m
- The Mean High Water Springs is **0.706m** AHD +/- 0.05m
- The Mean High Water Mark is **0.639m** AHD +/- 0.05m
- The Mean High Water Neaps is **0.573m** AHD +/- 0.05m
- The Mean Sea Level is **0.281m** AHD +/- 0.05m
- The Mean Low Water Neaps is **-0.011m** AHD +/- 0.05m
- The Mean Low Water is **-0.078m** AHD +/- 0.05m
- The Mean Low Water Springs is **-0.145m** +/- 0.05m
- The Indian Spring Low Water is -**0.313m** AHD +/- 0.05m

- Location: **Windsor**, Hawkesbury River
- Geographic Co-ordinates: MGA Zone 56, 297588E, 6279510N
- Period of data analysed: 2009-2010
- The High High Water Solstices Springs is **0.943m** AHD +/- 0.05m
- The Mean High Water Springs is **0.716m** AHD +/- 0.05m
- The Mean High Water Mark is **0.660m** AHD +/- 0.05m
- The Mean High Water Neaps is **0.605m** AHD +/- 0.05m
- The Mean Sea Level is **0.296m** AHD +/- 0.05m
- The Mean Low Water Neaps is **-0.012m** AHD +/- 0.05m
- The Mean Low Water is **-0.067m** AHD +/- 0.05m
- The Mean Low Water Springs is **-0.123m** +/- 0.05m
- The Indian Spring Low Water is -**0.286m** AHD +/- 0.05m

Mean High Water is an average level taken over 19 years of data, in the absence of 19 years of data the entire period of data will be analysed. In accordance with this 19-year cycle and sea level rise MHW levels will be updated each year. As per your request we have only supplied Tidal Planes calculated for the financial period of 01/07/2009 – 30/07/2010 which does not represent the standard method of using 19 years, or the equivalent of the entire collection period.

Thank you for your request, if you have any further questions regarding this request or other information held by MHL, please contact Sarah Hesse on (02) 9949 0265 at the Laboratory.

Yours faithfully

Sarah Hesse
Floodgroup Manager
Manly Hydraulics Laboratory

APPENDIX L: WATER LEVEL DATA PURCHASED FROM MANLY HYDRAULICS LABORATORY (CD)

HAWKESBURY CITY COUNCIL
HAWKESBURY RIVER DREDGING INVESTIGATIONS
SUMMARY REPORT

Refer attached CD