Infrastructure Assessment Paper- Manea Bridges

1 Introduction

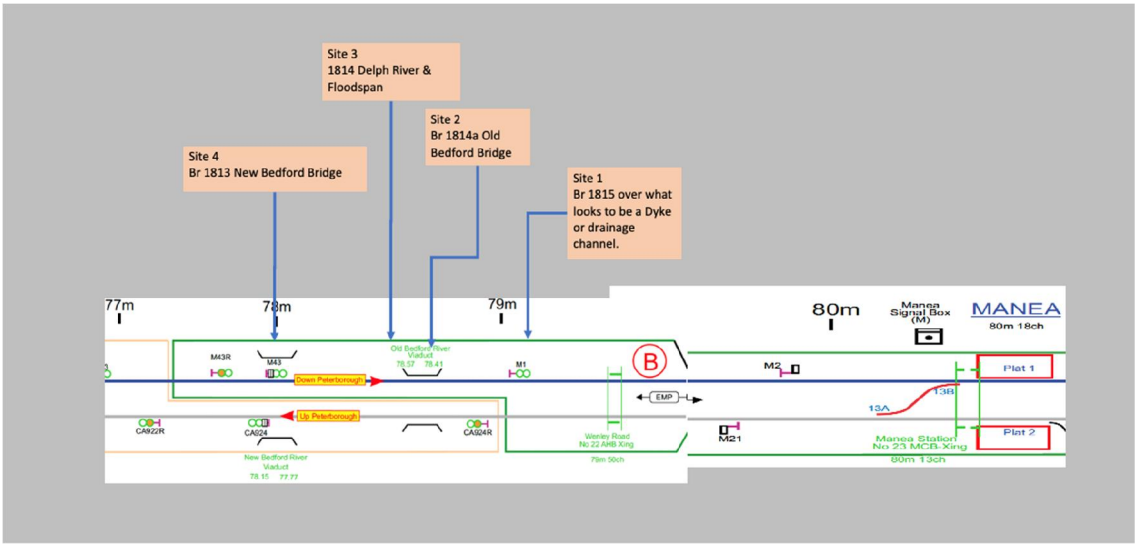
Old Bedford River/Counter Drain to the north-west. These rivers fall within the boundary of the Site of Special Scientific Interest. The Old Bedford River in particular is of national nature conservation importance in its own right.

Over the last few years we have had a number of issues with wheel timbers, a number have resulted the need for speed restrictions, some have failed in service, and one was a contributary factor in the derailment of a freight train. As a result, we have made a step change in our management processes, which included dedicated timber inspectors with improved training using new inspection equipment. We now have a much improved knowledge of our wheel timber assets, but this has identified a high volume of renewals that are required over the next two years. We are also renewing using hardwood which has a much longer life than the softwoods that have been used in the past. It should also be noted that the deterioration of soft wood timbers is not an exact science as is dependent on multiple factors. Therefore, getting an accurate estimation of the remaining life is very difficult, some timbers will last longer, and some will deteriorate faster.

There was a visual inspection undertaken on 30 July which confirmed that those identified in Early April as having 6 months life do need replacing with that 6 month window – which means within the next 2 months. The 4 week blockade will address the immediate issue plus all the immediate issues that would arise in the next 20 months (it was 24 months from the date of the April inspections). The output from the inspections is detailed in the reference document supplied under Asset Management Inspections May 2020.

1.1 Discrete Site information

The area referred to as Manea Bridges incorporates four elements of work in separate locations spread over circa 1m 20c and spanning both roads.



Manea Bridges Line Drawing 1

Sites 2 through 4 are existing known sites of concern and site 1 is a recently added site from the inspections completed in 2020. The assets are steel bridge with girder and longitudinal wheel timber configurations constructed in the early 1900's.

There are a large volume (circa 87 pairs) of wheel timbers which are in various stages of rot and unable to provide the required level of holding down strength for a large number of the baseplate coachscrews which hold the rail to the wheel timber and / or the transom spans which hold the gauge and are nearing life expired status. These are now requiring renewal with hardwood to remove the likelihood of a lower speed

restriction or closure of the line. Table 1 shows the level of rot in both timber and steel from pictures taken in previous interventions.

There is a need to undertake structural works to the bridge itself which is currently forecast to be commenced with design surveys in 2021, this paper however will focus purely on the wheel timber guide way system.

1.2 TOC / FOC Engagement

We always aim to engage with the Freight and Train Operating companies (FOC / TOC) as early as possible with a view of finding the best practicable solution (BPS) that enabled the works to be undertaken and a realistic train service window be offered. Both stakeholders (TOC/FOC) have been engaged since 2014 in the management of the Bridges as we have required disruptive access on an annual basis. Table 2 describes the 2018/2019 plan with worksites emphasising the level of discussions between Network Rail and our external stakeholders.

1.3 Maintenance Plans

We have had a consistent and robust maintenance and inspection regime going back to 2014 where we identified the need for a different approach to caring for this particular asset. This has ranged from using a chemical fixing agent (SpikeFast) to improve the holding down strength of coachscrews to single softwood timber replacement as shown in attachment (Manea Reference Document). The maintenance records are shown in a table format which was created from a direct download in Ellipse (Network Rail Electronic Management system).

Options were considered for rebuilding in 2017 and discarded as not viable at that time, however this is still under development in long range asset management. The assets require complete rebuilding which is normally a 10 to 15 year planning cycle as it requires Government approval and significant land purchases in a conservation area to be viable. Therefore, the rebuild was considered not to be an option for early rectification from that point.

1.4 Location Challenge

The Old Bedford River is an artificial, partial diversion of the waters of the River Great Ouse in the Fens of Cambridgeshire. The Old Bedford River was constructed was contrasted in 1603 to manage water levels flow. The Great Ouse is maintained for navigation, fisheries and aesthetic reasons but when there is excessive flow, the excess is diverted along the Bedford Rivers of which there are two, the Old and the New, between them lies the Ouse Washes.

The Ouse Washes play a major land drainage role as a flood water storage area and the washland is thus subject to regular winter flooding. In the summer months the area provides grazing and hay.

The majority of the site is under nature reserve management by the Bedfordshire and Huntingdonshire Naturalists' Trust, the Cambridgeshire and Isle of Ely Naturalists' Trust, the Royal Society for the Protection of Birds and the Wildfowl Trust.

Access restrictions from the Environmental and Natural England Agencies severely restrict the access from the normal 13 periods to around a 4 period basis which is outside of nesting and overstay seasons for birds. Alongside this the area is flooded during the Autumn to control water levels and potential flooding. This is dovetailed with the freight requirements for one of the busiest freight corridors in the UK.

2 Renewal History

The known renewal history is recorded in the Manea Reference document which includes renewal from a Works Delivery and Maintenance perspective. Where possible actual dates have been provided from support documents, however the detail in PPS (Possession Planning System) has not been provided due to technology constraints as outlined in Table 3.

The asset management teams have created a classification model (table 4) which confirms the life expectancy of a Wheel Timber.

2.1 2016

Maintenance changed a pair of wheel timbers under the maintenance schedules this identified the underlying concern over the condition of timbers at Manea and resulted in the introduction the use of speed restrictions with a 20mph Speed Restriction to slow down the rate of degradation.

2.2 2017

The second 20 Speed Restriction that drove wholesale Wheel Timber replacements was installed 21/08/2017 on both U&D roads.

Speed restrictions are required for two reason. The first is to reduce the rate of deterioration of the timers and the second is to reduce the impact of any derailment should a timber fail catastrophically. If a different access strategy was deployed the total amount of access required over the next two years would be more that within the 4 week blockade in order replace the volume of timbers identified. This is due to the start stop nature of a multi access strategy required over the next 20 months. During this period the risks would be controlled using speed restrictions, which would initially be at 20mph, dropping to 5mph, and then to 'block the line' if resources (track access, contractor, design, materials) cannot be mobilised in time.

The first intervention by Works Delivery took place in December 2017 where the plan was to replace a number of "Red" Wheel Timbers to remove the speed.

1814A	DN = 4 x Pairs UP = 3 x Pairs
1814	UP = 3 x Pairs
1813	DN = 3 x Pairs

In order to manage the asset better we instigated a 0 through 5 scale with 5 requiring renewal and 0 requiring no action.

2.3 2018

Saw the beginning of a more robust inspection regime using the revised escalation scales this drove up the number of timbers requiring replacement in 0-6 months.

1814A	DN = 4 x Pairs UP = 3 x Pairs
1814	DN = 7 x Pairs UP = 3 x Pairs
1813	DN = 6 x Pairs UP = 1 x Pairs

This saw an increase in timbers and significant element of top flange steel works which adds a unique difficulty to the timber replacement as it requires steelwork to enable the timber install requiring replacement.

During the consultations for the access in 2018 NR came under pressure not to undertake any works in 2019 at this location and finally after consultation with the external stakeholders (TOC / FOC / NE / EA) succumbed to an agreement of no invention in 2019.

This 12 month relaxation served to exacerbate the problem as decay in wood can speed up when left, especially in the environment where timber is exposed to long periods of moisture exposure.

2.4 2019

During this down time a more enhanced microprobe inspection system was developed improving the level of information available to the Engineer and upskilling the Inspectors undertaking the detailed inspections.

2.4.1 Revised Inspection Regime

The microprobe is a 2mm diameter needle that is fed electronically into the timber being tested, at a set feed rate and rotational speed. The resistance encountered produces a downloadable graph that can be interpreted by a trained individual to determine the presence of decay, voids, and or softness. This gives an indication of the remaining life of the timber.

It should be noted that once a timber reaches a certain stage of decay, the ability to predict lifespan becomes extremely difficult and the behaviour of the timber becomes unpredictable particularly in the last 2 years of life.

Our policy now is to intervene with a timber renewal before the timber enters the “period of unpredictability”. This led to an increase in “Red” categorised timbers from the more accurate assessments and the time between interventions being pushed from 12 to 24 months drove up the volume of timbers that degraded.

3 Current Access Consultations

3.1 Optioneering

There are a number of unique delivery considerations that have to be applied when undertaking this type of works which include but are not limited to:

- Flooding arrangements by the Environmental Agencies increase the water height to above the level of the working platforms. This normally takes place between October and March annually.
- Seasonal restrictions with bird conservation and wildlife management, this includes noise, colour and light conservation. These normally span October through to March and accommodate a wide and varied range of bird species from Geese to Starlings and include several species on the endangered list.
- Access and Egress travelling times from storage areas to site of works.
- Steel work rivet patterns are unique requiring several laydowns, mark ups and reinstatement to make the timber fit, coupled with varying heights of old hand worked rivets and bolts.
- Top Flange steel work repairs prior to timber installation can only be identified when the timber is removed.
- Level Crossing and Road closure management
- Network Services for national delivery as Whitemoor is a staging point between the north and south.

Numerous other influencers are available; however, these could be considered the top seven notwithstanding our external stakeholders (FOC / TOC) requirements to operate.

Figures 2 & 3 in the appendices reflect the level of detail (minutes) activities were broken down into to establish estimated working times by location and worksite to underpin the optioneering.

An element of light informal consultation was undertaken to test the TOC view via the Route Access Planning team and the internal freight management team.

The freight timetable was not known fully at the optioneering stage; assumed pathing opportunities exist.

Passenger traffic has been suspended for the 28 days to support the extraordinary situation we are in; NR are cancelling some if the planned possession to ease the alternative route congestions through London.

3.2 Priority Renewals

There are some critical renewals at Littleport via our High Output system in weekend of week 24 that is an urgent item of works on the BGK line of route that needs to remain along with the trip services to support the works that are running in week 23.

There is also a trip required post Week 24 Littleport works for the system (6X04) to transit to Scotland for its campaign in the North.

3.3 Urgent Maintenance

There are 2 urgent ballast trains required for Shenfield to Ingatestone required to top up the ballast shoulders and four foot areas for HEAT related speeds.

4 Appendices

Table 1 Evidence of decay

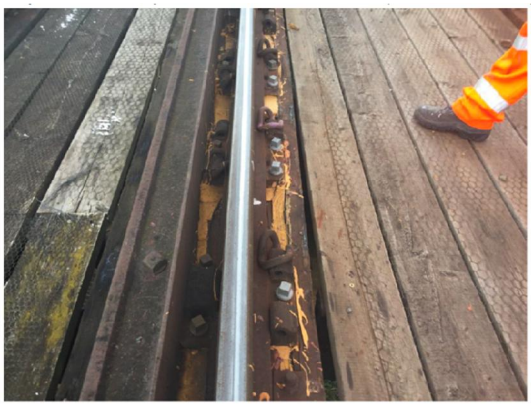
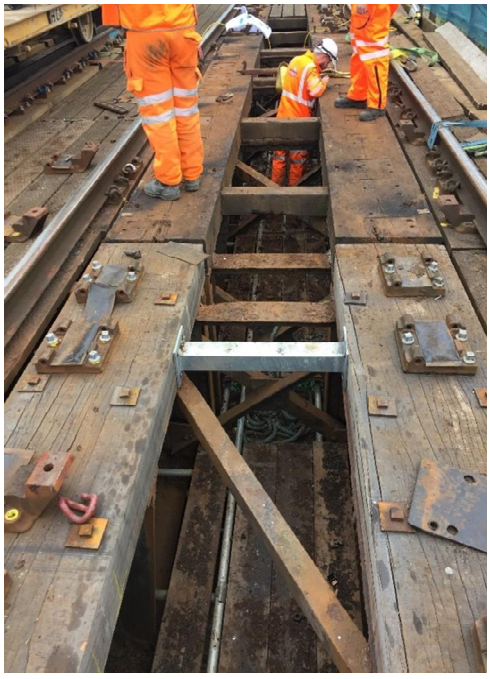
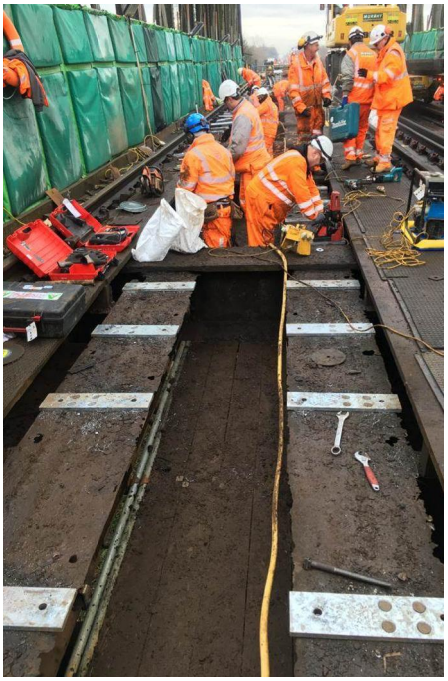
		
Maintenance remedial works	Evidence of rot in timber	Evidence of steel decay
		
Evidence of timber split	Evidence of steel repairs	

Table 2 2018 / 2019 Plan with worksite references

Year 2018/19	Plan						
	Week No.	Potential times From	To	Worksite No.	Possession	ACT Req	Times	Notes
	18	2300 Sat	0830 Sun		No	Yes	9hrs 30m	
	19	2255 Sat	0915 Sun		No	Yes	10hr 20m	
	20	0100 Sun	0850 Sun		P/2443347	Yes	7hrs 50m	High Output worksite 73m 60ch - 76m 60ch
	21	2350 Sat	0840 Sun		P/2301769	Yes	8hrs 50m	
	22	Protected paths in place				Yes	0	
	~~23~~	~~0100 Sun~~	~~0850 Sun~~		~~P/2448289~~		~~0~~	~~High Output worksite 73m 60ch - 76m 60ch~~ - Not compatible with HOBC
	24	0100 Sun	0815 Sun	6131333	P/2447414		7hr 15m	High Output worksite 73m 60ch - 76m 60ch - requires block to be extended out
	25	0030 Sun	1030 Sun	6131339	No		10hr	
	26	2300 Sat	0745 Sun	6131358	No		8hr 45m	Protected Path P/2465431 from 0745 Sun
	27	0030 Sun	2300 Sun	6056040	P/2363433		22hr 30m	Disruptive block
	28	0030 Sun	2300 Sun	6056062	P/2307455		22hr 30m	Disruptive block
	29	2255 Sat	0700 Sun	6131364	No		8hr 5m	Protected Path P/2468316 from 0700 Sun
	30	Protected Path					0	
	31	0120 Sun	0800 Sun	6131369	P/2547472		6hr 40m	PP P/2492373 from 0815 Sun
	32	0100 Sun	0830 Sun	6131372	P/6131372		7hr 30m	PP P/2471576 until 0115 Sun
	33	2350 Sat	1050 Sun	6131377	P/2433168		11hr	Confirmed with Tott DU to link into cyclical
	34	0105 Sun	1030 Sun	6131381	P/2554462		9hr 25m	
	35	0050 Sun	0830 Sun	6131384	P/2557928		7hr 40m	PP P/2477424 from 0850 Sun
	36	2255 Sat	1045 Sun	6131387	P/2561194		11hr 50m	
	37	2350 Sat	0900 Sun	6131391	P/2424340		9hr 10m	Confirmed with Tott DU to link into cyclical
		2240 Mon	0435 Tue	6236988	P/2461652			Agreed with Ely DU
		2240 Tue	0435 Wed	6236997	P/2461743			Agreed with Ely DU
		2240 Wed	0435 Thur	6236999	P/2461744			Agreed with Ely DU
		2240 Thur	0435 Fri	6237000	P/2461745			Agreed with Ely DU
	38	2255 Sat	1045 Sun	6131393	P/2565101		11hr 50m	
	39	2255 Sat	0900 Sun	6131398	No		10hr 25m	PP P/2486907 from 0920 Sun
	Christmas	2315 Mon	0400 Thur	6131400	P/2548099		52hrs	Additional disruptive possession
	41	0200 Sun	0900 Sun	6156403	No		7hr	PP P/2504664 until 0200 Sun, P/2498791 from 0900 Sun
	~~42~~	~~0300 Sun~~	~~0800 Sun~~				~~5hr~~	~~PP P/2498803 until 0300 Sun~~
	43	0050 Sun	0700 Sun	6156482			6hr 10m	PP P/2502227 from 0700 Sun
	44	2315 Fri	0250 Mon	6252726	NEW		52hr	Additional disruptive possession
	44	01:00 Sat	15:00 Sat	6252726			14hrs	Working time available in week 44 access.
	44	21:00 Sat	13:00 Sun	6252726			16hrs	Working time available in week 44 access.
	44	19:00 Sun	03:00 Mon	6252726			8hrs	Working time available in week 44 access.
	45	0030 Sun	0830 Sun	6156488	P/2425329		8hr	Confirmed with Tott DU to link into cyclical
		2250 Sat	0250 Mon	6252735	NEW		27hr	Additional disruptive possession
	45	01:00 Sun	07:00 Sun	6252735			6hrs	Working time available in week 45 access.
	45	12:00 Sun	02:50 Mon	6252735			14.50hrs	Working time available in week 45 access.
	46	2250 Sat	0250 Mon	6252738	NEW		27hr	Additional disruptive possession
	46	09:00 Sat	09:00 Sun	6252738			9hrs	Working time available in week 46 access.
	46	21:00 Sun	03:00 Mon	6252738			6hrs	Working time available in week 46 access.
	47	0050 Sun	0720 Sun	6156538			6hr 30m	PP P/2507436 until 0050 Sun, P/2507438 from 0830 Sun
		2250 Sat	0250 Mon	6256866	NEW		27hr	Additional disruptive possession
	47	22:50 Sun	08:00 Sun	6256866			9hrs	Working time available in week 47 access.
	47	12:00 Sun	02:50 Mon	6256866			15hrs	Working time available in week 47 access.
	48	0100 Sun	0720 Sun	6156542			6hr 20m	PP P/2507646 until 0100 Sun, P/2507654 from 0830 Sun
		2250 Sat	0250 Mon	6256867	NEW		27hr	Additional disruptive possession
	48	01:00 Sun	08:00 Sun	6256867			7hrs	Working time available in week 48 access.
	48	16:00 Sun	03:00 Mon	6256867			11hrs	Working time available in week 48 access.
	49	0030 Sun	0830 Sun	6156548			8hr	PP P/2515540 until 0030 Sun, P/2521143 from 0830 Sun
		2250 Sat	0250 Mon	6252739	NEW		27hr	Additional disruptive possession
	49	22:50 Sun	10:00 Sun	6252739			11hr 10m	Working time available in week 49 access.
	49	17:00 Sun	02:50 Mon	6252739			9hr 50m	Working time available in week 49 access.
	50	2255 Sat	1045 Sun	6156557			11hr 50m	
	51	0030 Sun	0830 Sun	6156553	P/2425330		8hr	Tott DU PL Tamper 74mp - 81mp
	52	0300 Sun	1045 Sun	6156554			7hr 45m	PP P/2515535 0100 - 0300 Sun

Table 3 PPS Technology Failure

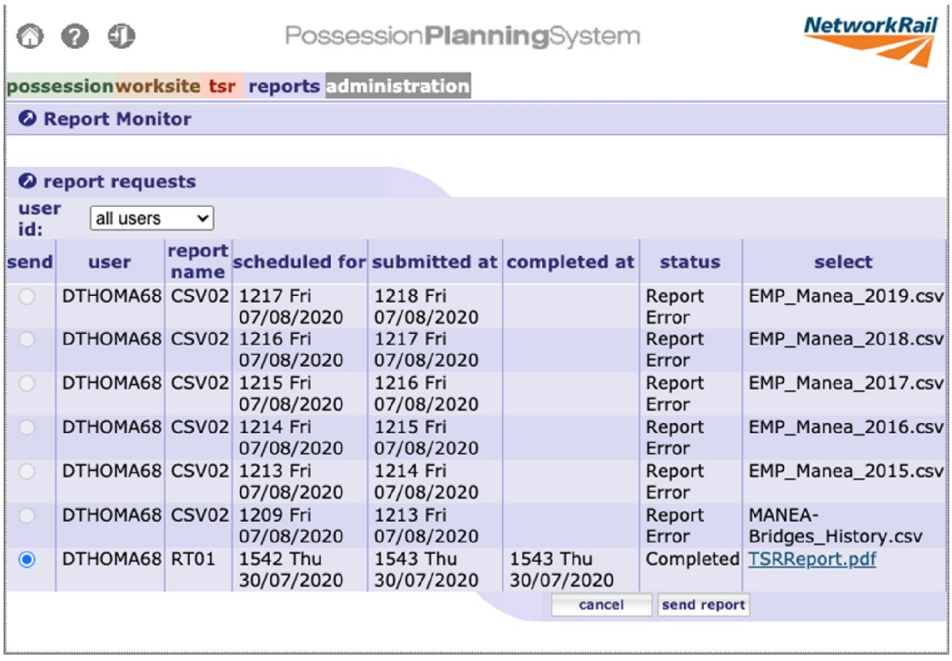


Table 4 Asset Management categorisation

	0 - 6 months
	12 months
	18-24 months
	36 - 48 months
	Replaced Hardwood (new)

Table 5 Wheel Timber Priorities

Manea Bridges Wheeltimber Replacement Locations V1

Location						Down		Up	
						2100		1100	
		ELR	Start Miles	End Miles	No.	Left	Right	Left	Right
1815	?	EMP	?	?	2	6m	6m	6m	6m
					1	6m	6m	6m	6m
Ballast section									
1814A	Old Bedford River	EMP	78m53c	78m58c	11			12m	12m
					10	Completed	Completed	Completed	Completed
					9	Completed	Completed	Completed	Completed
					8	12m	12m	12m	12m
					7	2y	2y	12m	12m
					6	2y	2y	12m	12m
					5	Completed	Completed	Completed	Completed
					4	Completed	Completed	Completed	Completed
					3	Completed	Completed	Completed	Completed
					2	Completed	Completed	6m	6m
					1	Completed	Completed	12m	12m
Ballast section 78m 51ch to 78m 53ch									
1814	Flood Span	EMP	78m43c	78m51c	27	6m	6m	6m	6m
					26	2y	2y	6m	6m
					25	Completed	Completed	6m	6m
					24	3y	3y	12m	12m
					23	2y	2y	Completed	Completed
					22	2y	2y	Completed	Completed
					21	2y	2y	Completed	Completed
					20	2y	2y	12m	12m
					19	6m	6m	12m	12m
					18	3y	3y	2yr	2yr
					17	3y	3y	12m	12m
					16	2y	2y	2yr	2yr
					15	2y	12m	2yr	2yr
					14	2y	2y	12m	12m
					13	3y	3y	12m	12m
					12	3y	3y	6m	6m
					11	Completed	Completed	2yr	2yr
					10	Completed	Completed	3yr	3yr
					9	2y	2y	12m	12m
					8	2y	2y	12m	12m
					7	2y	2y	Completed	Completed
					6	2y	2y	12m	12m
					5	2y	2y	12m	12m
					4	6m	12m	6m	6m
					3	Completed	Completed	Completed	Completed
					2	2y	3y	12m	12m
					1	Completed	Completed	12m	12m
Ballasted section 78m 15ch to 78m 43ch									
1813	New Bedford River	EMP	78m3c	78m15c	31	Completed	Completed		
					30	2y	12m	Completed	Completed
					29	12m	2y	6m	6m
					28	Completed	Completed	4y	4y
					27	2y	2y	2y	3y
					26	Completed	Completed	4y	4y
					25	2y	2y	4y	4y
					24	Completed	Completed	4y	4y
					23	Completed	Completed	2y	12m
					22	2y	12m	4y	4y
					21	6m	12m	Completed	Completed
					20	12m	2y	6m	6m
					19	3y	3y	6m	6m
					18	12m	2y	2y	2y
					17	6m	12m	2y	2y
					16	2y	3y	2y	2y
					15	Completed	Completed	2y	2y
					14	4y	4y	2y	2y
					13	2y	2y	4y	4y
					12	12m	12m	2y	2y
					11	3y	3y	2y	2y
					10	12m	12m	Completed	Completed
					9	12m	12m	Completed	Completed
					8	4y	4y	3y	3y
					7	2y	2y	3y	3y
					6	2y	12m	3y	3y
					5	2y	2y	3y	3y
					4	12m	12m	3y	18m
					3	6m	12m	12m	18m
					2	3y	3y	Completed	Completed
					1	3y	3y	6m	12m