Civil Engineering Update

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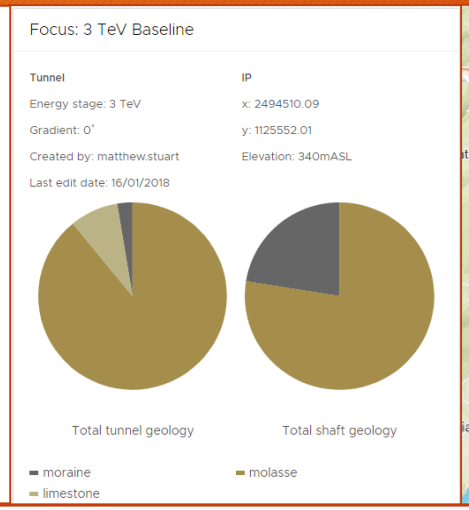
Introduction - Content

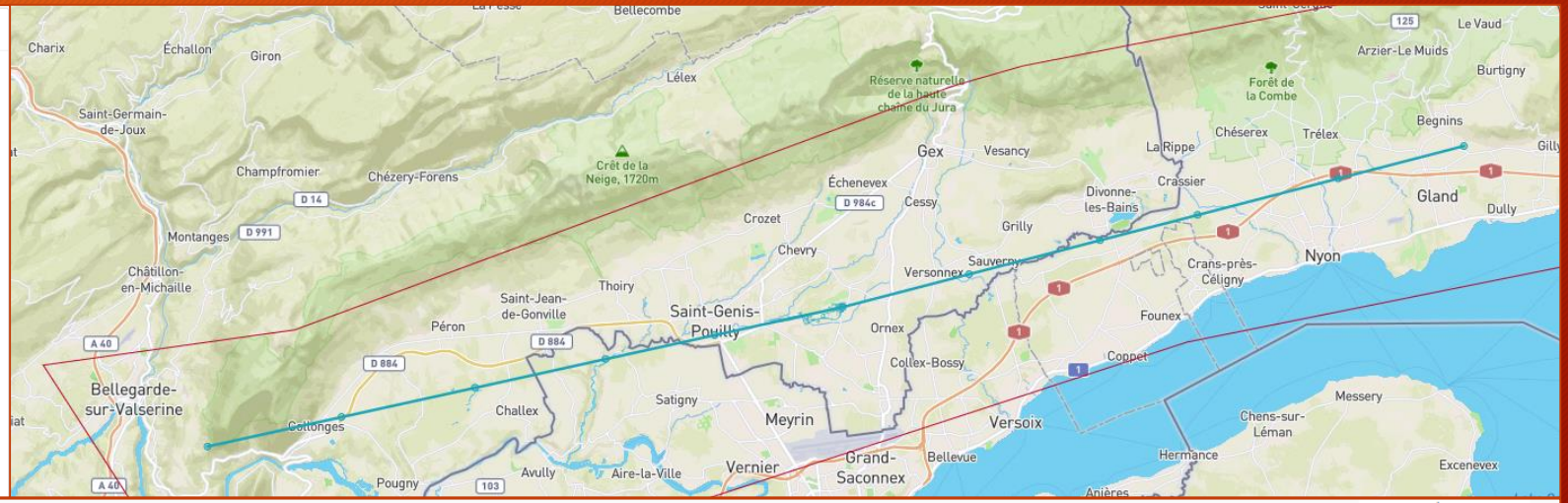
- Civil Engineering – CLIC Siting.
  - 380 GeV Siting optimisation
  - 1.5 TeV & 3 TeV Siting
- Project Implementation Plan.
  - Civil Engineering
  - CEIS and deadlines
- PBS Cost Update
  - CEIS and deadlines.

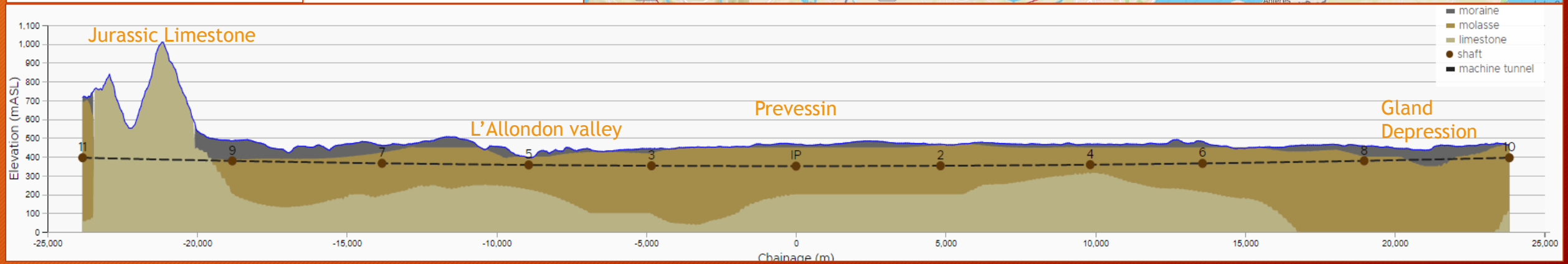
CDR Location

Highlights:

- Only one sector containing limestone and moraines
- IP On existing CERN land.
- 380 GeV stage located entirely in France.
- Only one sector with extremely large overburden.





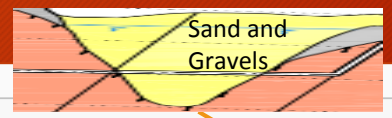


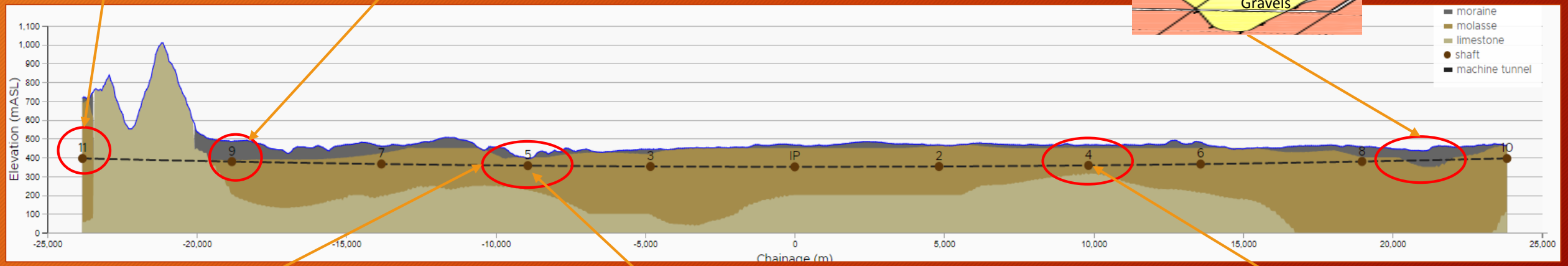
Key Issues with the CDR Design

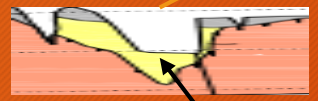
<u>Issue:</u> Very Deep Shaft (331m)
- Replace with inclined access tunnel.
- Locate shaft at a different chainage.
- Re-position CLIC.

<u>Issue:</u> Cavern excavation very close to water bearing moraines.
- Increase depth of the tunnel
- Locate shaft & cavern at a different chainage.
- Re-position CLIC.

<u>Issue:</u> Tunnel excavation through Sand and gravel filled valley.
- Excavation using an earth pressure balance shielded TBM.
- Double lining waterproofing method.







Sand and Gravels

<u>Issue:</u> Shaft excavation through Sand and gravel filled valley – protected area.
- Relocate shaft.
- Replace with inclined access tunnel.
- Re-position CLIC.

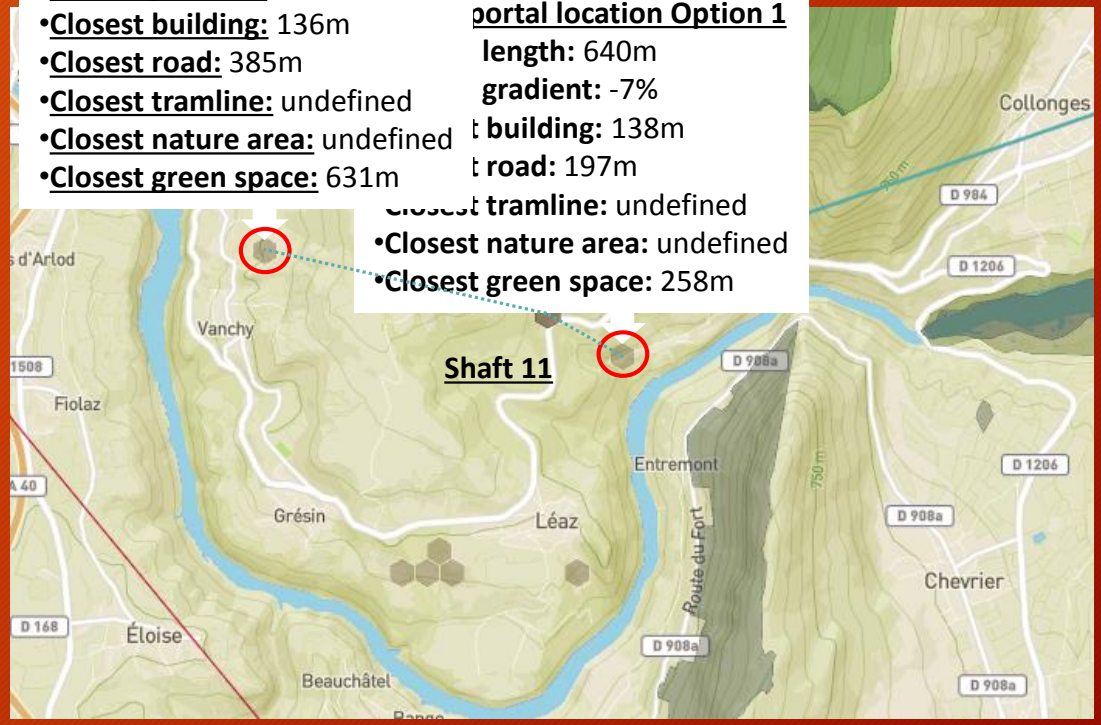
<u>Issue:</u> Shaft located in a protected area.
- Relocate shaft.
- Replace with inclined access tunnel.
- Re-position CLIC.

Potential solutions – Inclined Access Tunnels Shaft 11

1. Replacing Shaft 11 with inclined access tunnel as proposed in the CDR
   - Option 1:
     - ✓ Provides an adequate inclined tunnel length.
     - ✓ No surface constraints.
     - ✓ Ease of access - adjacent to a railway line
     - × Tunnelling through the Jura Limestone
   - Option 2:
     - ✓ No surface constraints.
     - ✓ Tunnel avoids the Jurassic Limestone
     - ✓ Tunnel gradient is sufficiently low.
     - × Increased tunnel length.
     - × Difficult access location

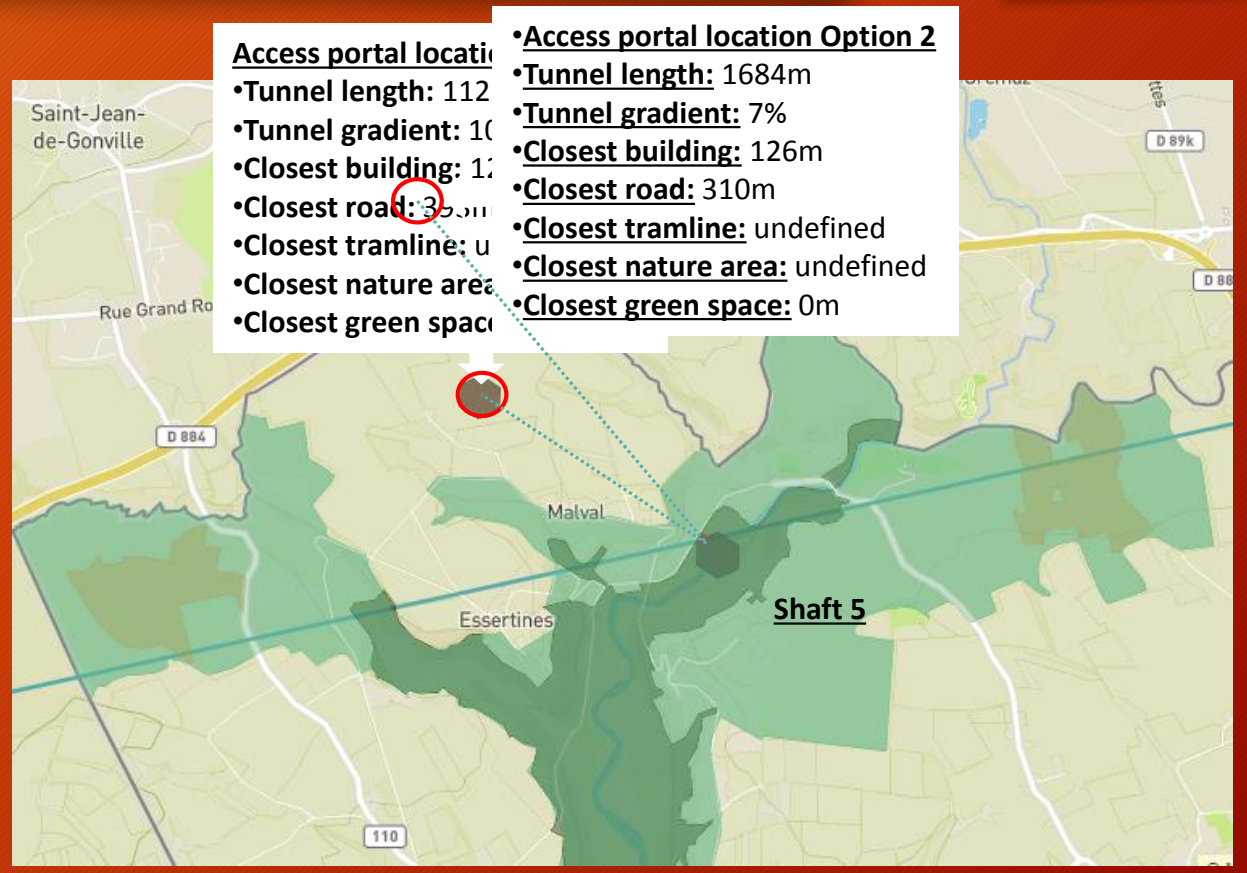
Access portal location Option 2
- **Tunnel length:** 2038m
- **Tunnel gradient:** 7%
- **Closest building:** 136m
- **Closest road:** 385m
- **Closest tramline:** undefined
- **Closest nature area:** undefined
- **Closest green space:** 631m

portal location Option 1
- **length:** 640m
- **gradient:** -7%
- **building:** 138m
- **road:** 197m
- **tramline:** undefined
- **Closest nature area:** undefined
- **Closest green space:** 258m

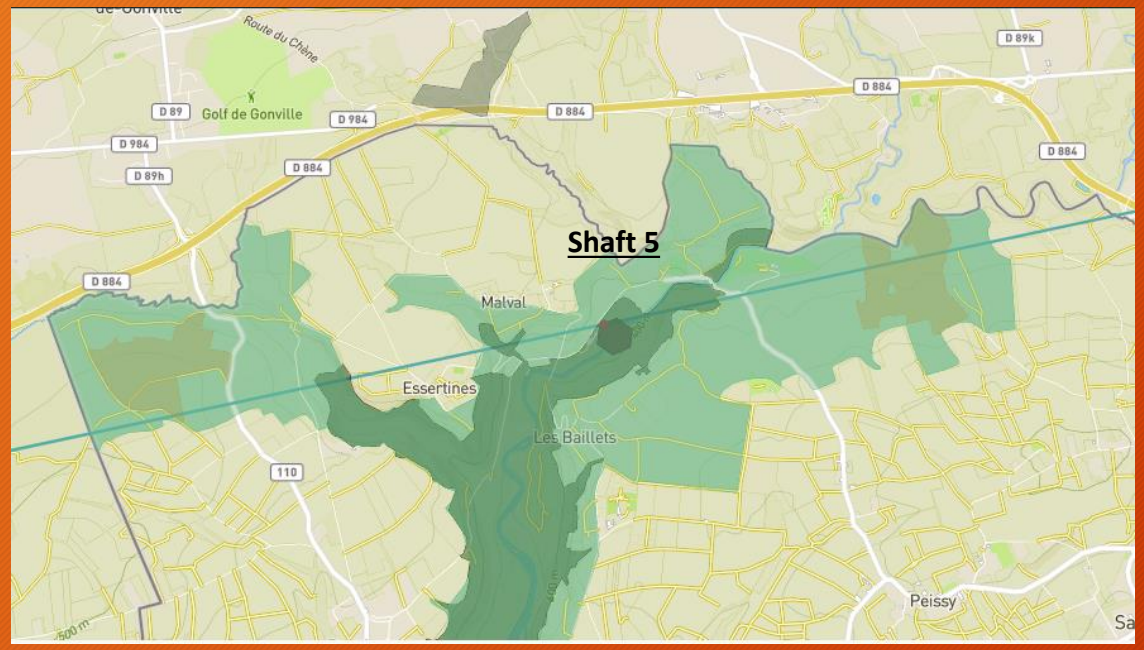


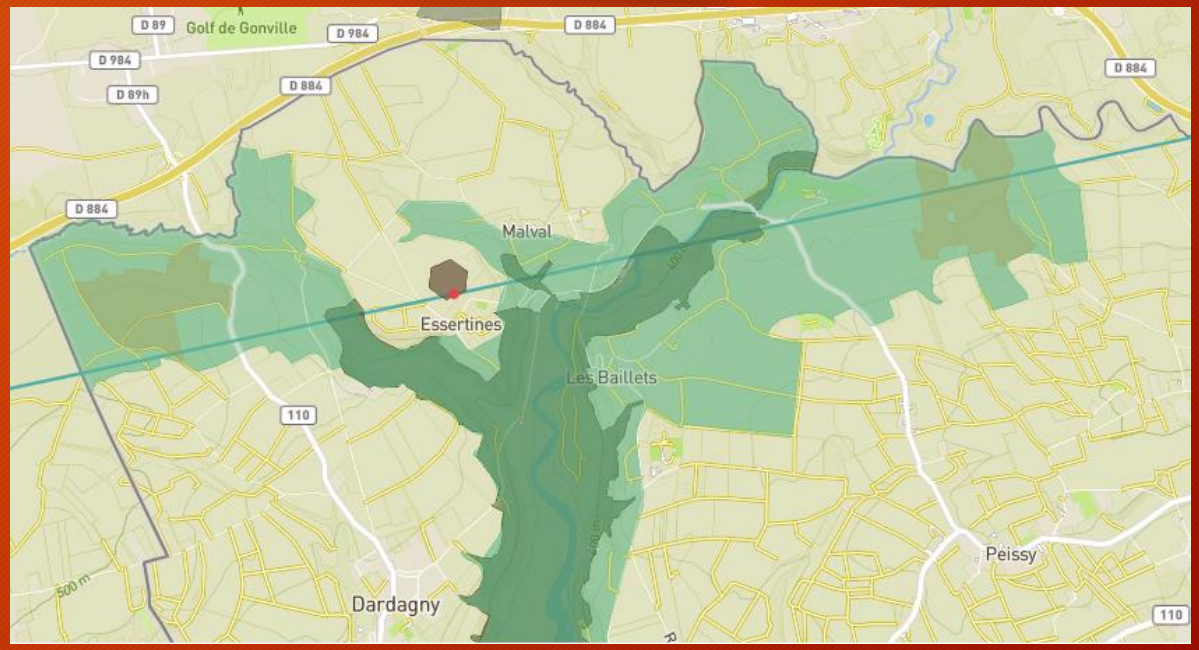
Potential solutions – Inclined Access Tunnels shaft 5

1. Replacing Shaft 5 with inclined access tunnel
   - Option 1:
     - ✓ Provides an adequate inclined tunnel length.
     - ✓ No surface constraints.
     - ✓ Tunnel avoids the Limestone.
     - × Gradient higher than option 2.
   - Option 2:
     - ✓ No surface constraints.
     - ✓ Tunnel avoids the Limestone
     - ✓ Tunnel gradient is sufficiently low.
     - × Increased tunnel length.
     - × Surface located on green space.



Potential solutions – Shaft 5 Relocation

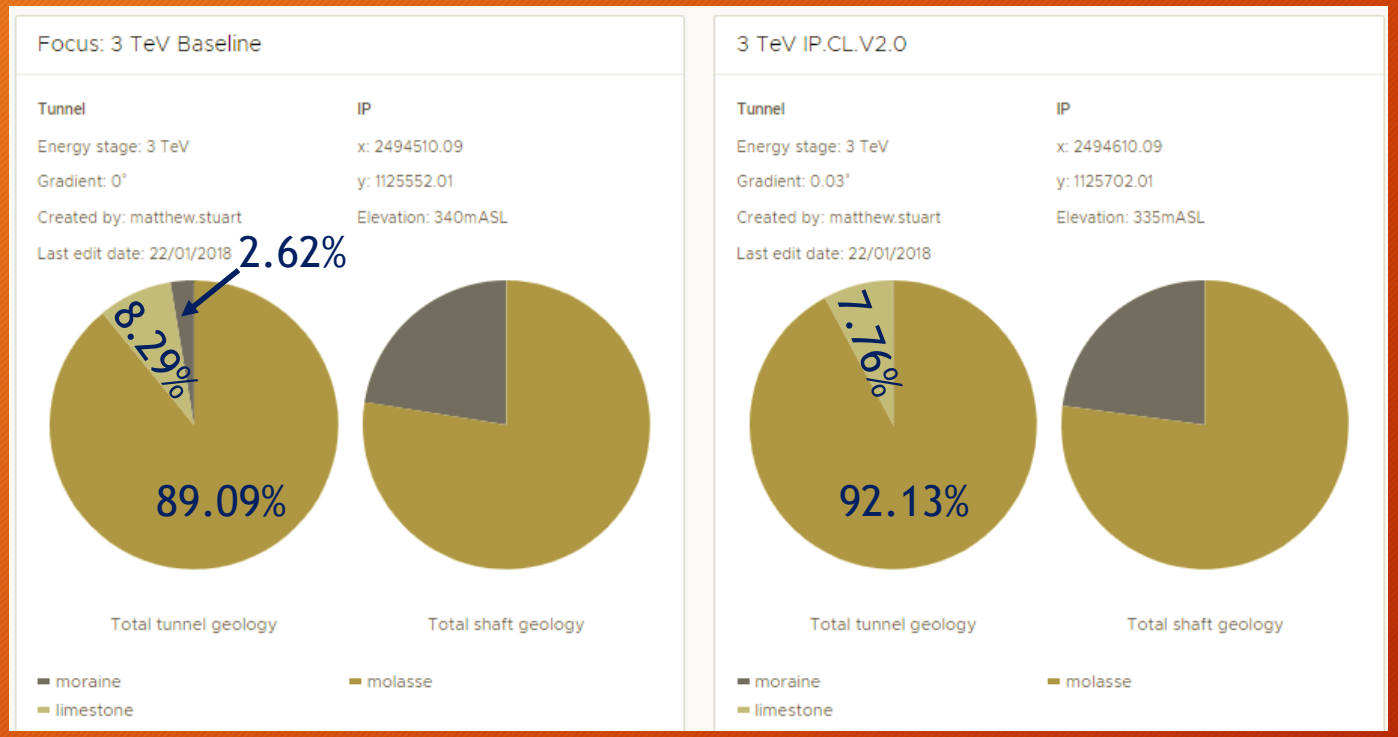




1. CDR Shaft Location
   - ✓ Shallow shaft.
   - × Difficult excavation through sand and gravel.
   - × Located in a nature reserve and wetlands.
   - × Located very close to the Allondon River.
   - × Located very close to existing buildings.

1. New Shaft Location
   - Option 1:
     - ✓ Shaft no longer located in nature reserve or wetlands.
     - ✓ No longer too close to Allondon River.
     - × Close to existing roads.

Potential solutions – Reposition tunnel, IP remains on CERN land

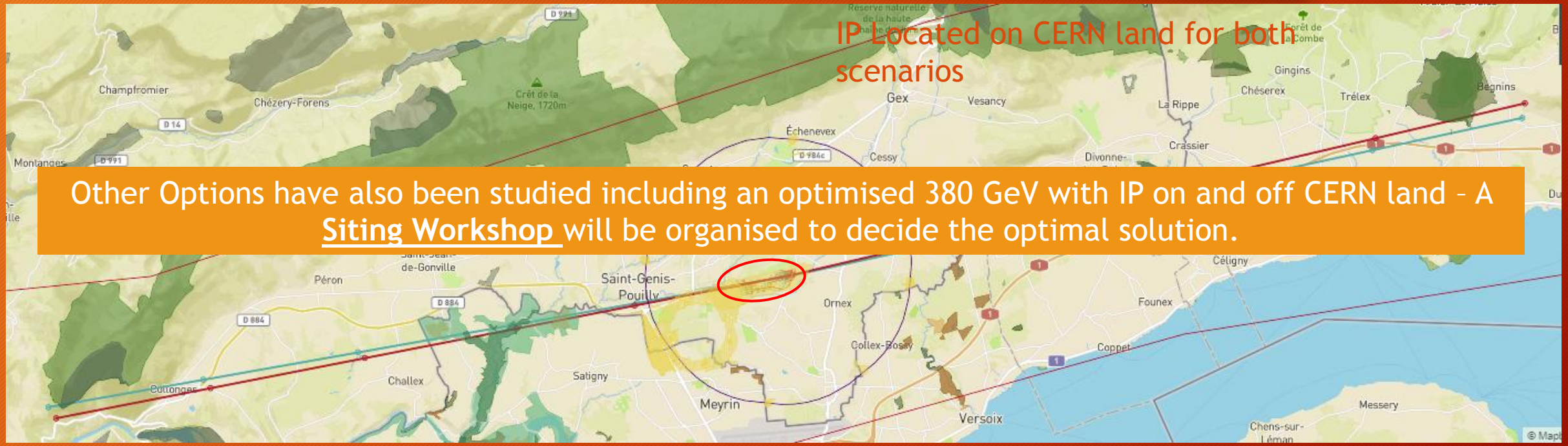


Total Shaft length: 1,175.37m

Total Shaft length: 1,369.86m

- ✓ Total shaft Length reduced by approximately 14%
- ✓ Shaft 11 reduced from 331m to 178m
- ✓ Tunnel length through moraines and limestone reduced.

Potential solutions – Reposition with IP on CERN land - Summary



Other Options have also been studied including an optimised 380 GeV with IP on and off CERN land – A **Siting Workshop** will be organised to decide the optimal solution.

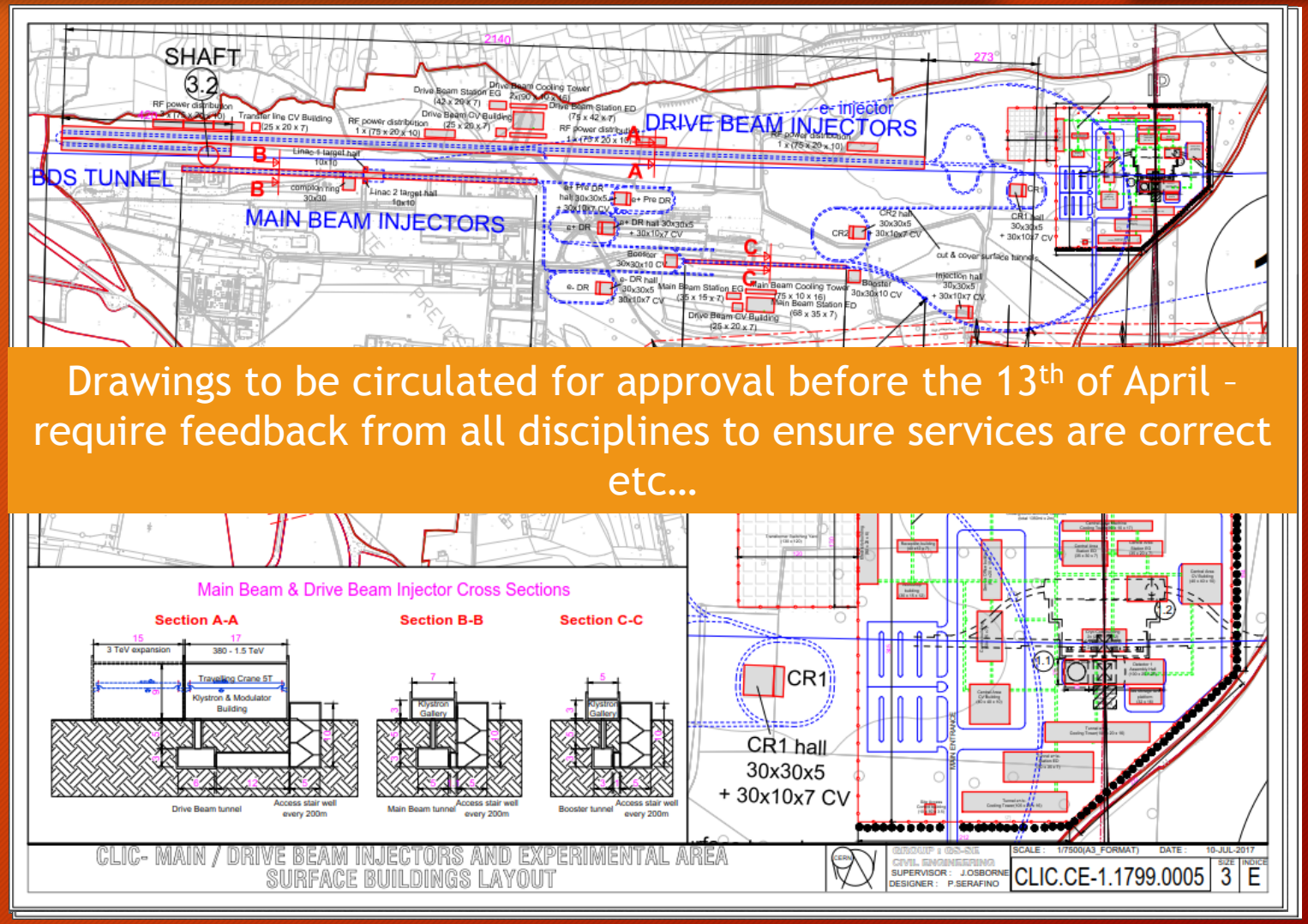
1. CDR CLIC Location - Blue
   - × Exceptionally deep shaft 11
   - × Shaft 5 Located in a nature reserve and wetlands.
   - × Passes through the Gland Depression.
   - × Shafts 3 and 5 located very close to buildings.
   - × Shaft 9 cavern located too close to the moraine
   - × Shaft 4 Located in a protected area.

1. New CLIC Location - RED
   - ✓ Shaft 11 No longer too deep.
   - ✓ Tunnel no longer passes through the Gland Depression.
   - ✓ No shafts are too close to buildings.
   - ✓ Shaft 9 Cavern an adequate distance from moraines.
   - ✓ Shaft 4 no longer located in a protected region
   - × Shaft 5 Located in a nature reserve and wetlands.

Project Implementation Plan (PiP)

Drawings to be used in the PiP:

1. Klystron Cross-section
2. Drive beam Cross-section
3. Shaft Cross Section
4. Three stage tunnel Layout.
5. Central Injection Complex, Drive beam and Klystron

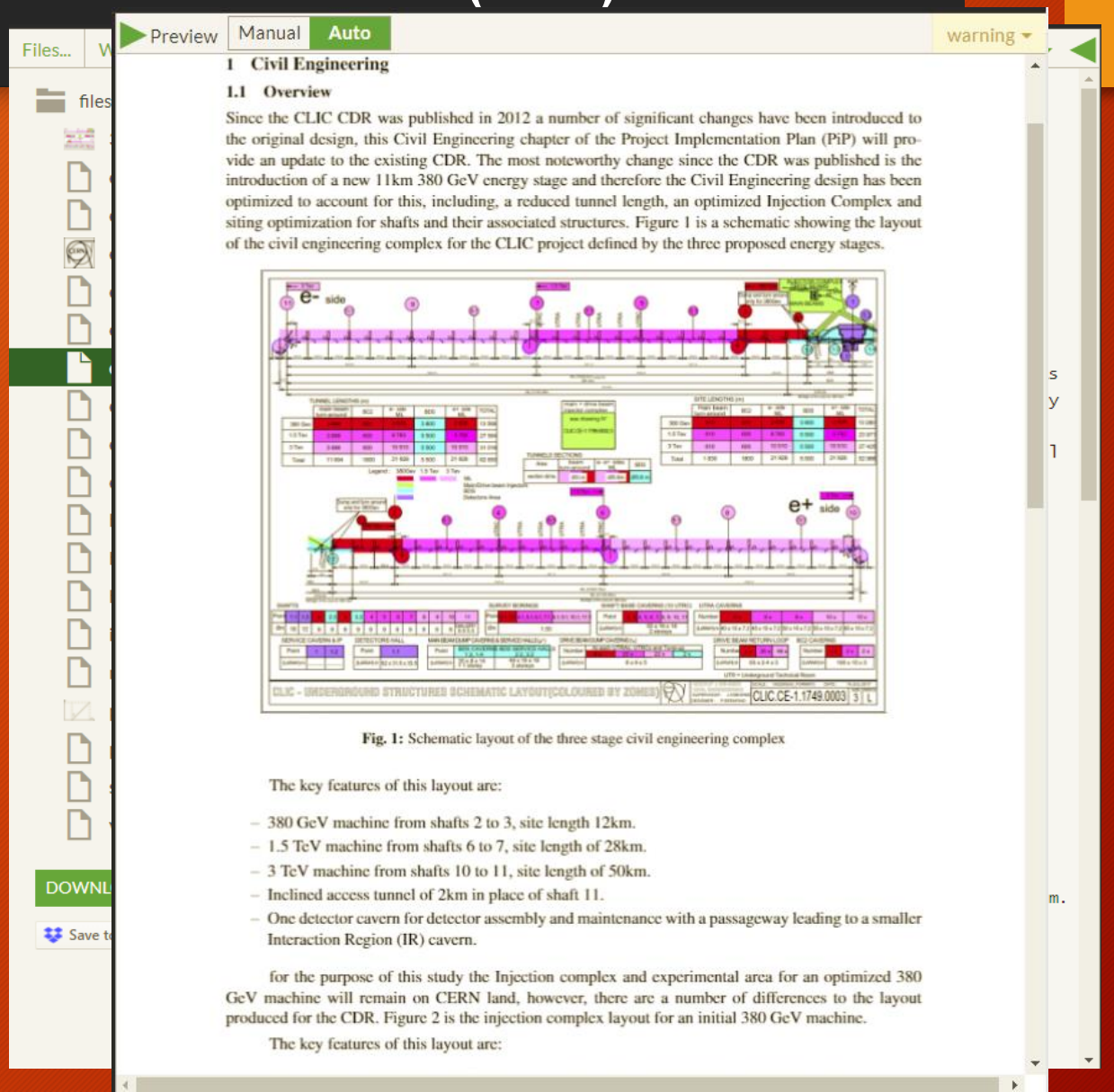


Drawings to be circulated for approval before the 13th of April – require feedback from all disciplines to ensure services are correct etc…

Project Implementation Plan (PiP)

Source code and layout of the Civil Engineering document is based on the CDR.

1. Latex template has been provided for us.
2. Need to decide on how to separate the Drive beam and Klystron options?
3. Willing to provide help using Latex if required…



Project Implementation Plan (PiP)

BACKGROUND MATERIAL:

There is a Folder called CDR_2012 which contains folders corresponding to the sections (in some cases chapters) from the CDR. Inside each folder is:

- Latex source file (Civil Engineering are using Latex)
- All figures (as pdf files)
- A pdf version of the section/chapter as it appeared in the CDR

FOR THE NEW PiP:

Also on the Workspace there is a folder called Latex, which contains all the templates, style files, class files and examples needed for Latex users. We would prefer latex source but there is also a Word template in the folder call Word. (information can be provided by Civ. Eng. if required)

What we are asking you to do now:

1. Please discuss (hopefully already done!) the scope of your section with your chapter editor.
2. Check the workspace for the background CDR material and template file for the PiP.
3. For questions or queries on technical procedures please email CLIC-Pip_editors@cern.ch
4. We would like you to produce a first draft of your section by **April 13th.**
5. Send your draft section to your chapter editor by **April 13th** at the latest.

We suggest a review of all first-draft sections at a dedicated CLIC project meeting on **April 19th** p.m. NOTE THIS IS A FEW DAYS EARLIER THAN ANNOUNCED LAST WEEK AT THE CLIC WORKSHOP, DUE TO ROOM AVAILABILITY; WE CANNOT GO LATER BECAUSE OF IPAC.

https://dfsweb.web.cern.ch/dfsweb/Services/DFS/DFSBrowser.aspx/Workspaces/c/CLIC_PiP

Project Implementation Plan (PiP)

Status Update for the CEIS PiP, each discipline to provide:

1. A status update
2. First Draft completion estimation

Status
Not Required
To Do
In Progress
Ready For Review
Under Review

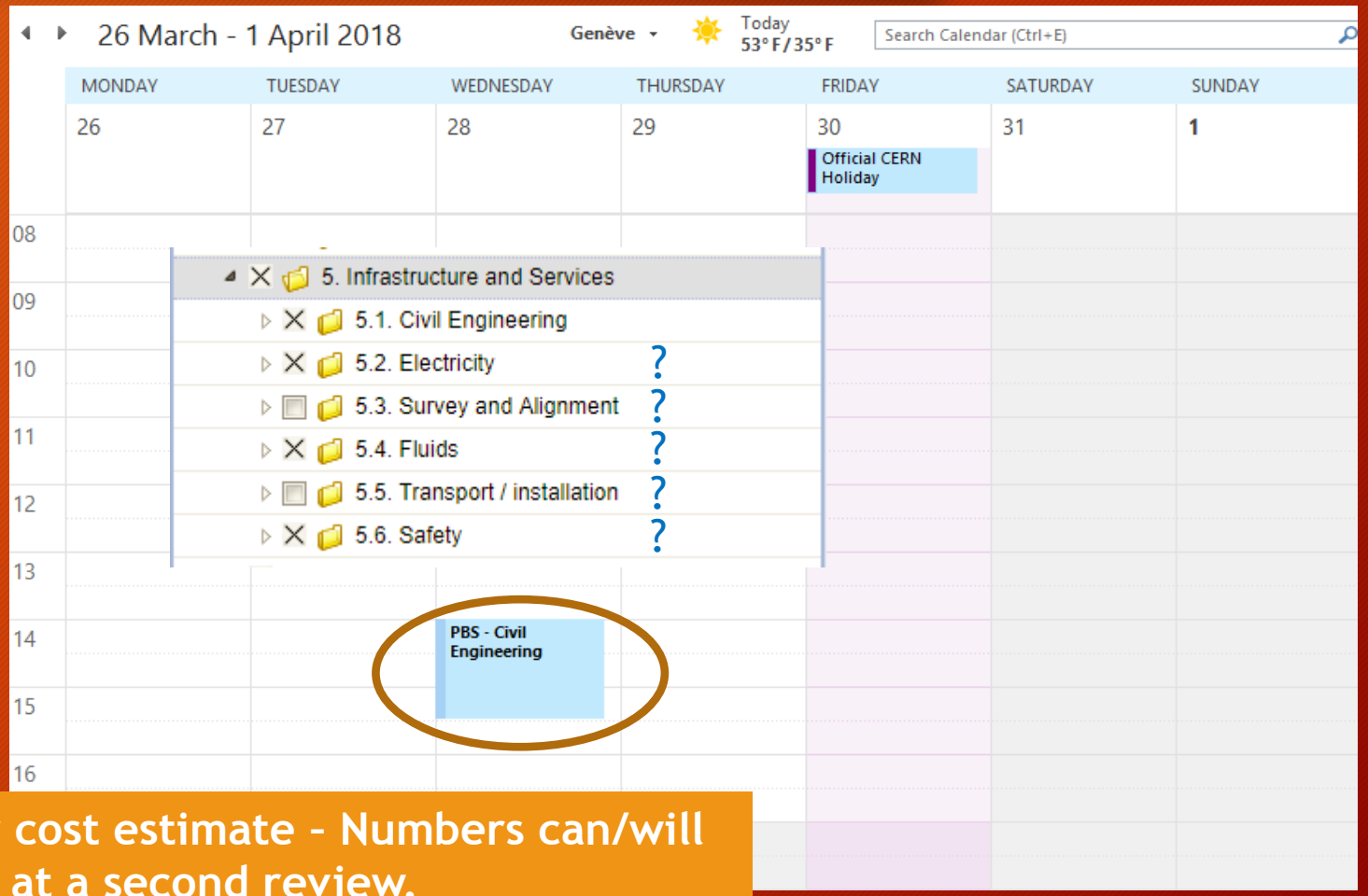
09/03/2018

CEIS

Chapter/Section	Person(S) Responsible	Pages Produced	Pages Allocated	Status Update	First Draft Required	First Draft Completion	Final Draft Required	Notes on Status and Progress
6.2 Civil Engineering	J.Osborne	3	5	In Progress	13/04/2018		31/09/2018	
6.3 Electicity supply	D.Bozzini	0	3	To Do	13/04/2018		31/09/2018	
6.4 Cooling and Ventilation	M.Nonis	0	3	To Do	13/04/2018		31/09/2018	
6.5 Transport and Installation	I.Reuhl	0	3	To Do	13/04/2018		31/09/2018	
6.6 Safety systems inc. Environ. and Access	S.Marsh	0	3	To Do	13/04/2018		31/09/2018	
6.7 Radiation Safety	M.Widorski	0	3	To Do	13/04/2018		31/09/2018	
6.8 Cryo	D.Delikaris	0	3	Not Required	13/04/2018		31/09/2018	Is this Still Required

PBS Cost Update

1. The PBS has been compiled and all nodes updated
2. Next Step: Provide a Cost Update before the end of April.
3. Civil Engineering is scheduled for the 28th of March – Need to schedule dates for other disciplines



This is Just a preliminary cost estimate – Numbers can/will be updated at a second review.

Further Study

Civil Engineering

- A siting workshop to identify the most favourable options.
- Update Civil Engineering cost and schedules for the optimised tunnel locations.
- Continue to update and integrate all disciplines into the surface and tunnel layouts and designs.
- Circulate Drawings and get feedback from all disciplines before the 13th of April.
- Follow up on all tasks from task worksheet.

Thank You For Your Attention

Thank you to all contributors from the CLIC CEIS Working Group

Civil Engineering – Tunnel Optimisation Tool Demonstration

UPLOAD LATTICE FILE | NEW | CLONE | DELETE

	Title	Description	Energy stage	IP location	IP elevation	Rotation	Gradient	Created by	Last edited	Parent scenario
☐	380 GeV Baseline	Baseline Design, not to be changed.	380 GeV	2494510.09, 1125552.01	350	41°	0°	admin	15/01/2018	Parent scenario
☐	1.5 TeV Baseline	Baseline Design, not to be changed.	1.5TeV	2494510.09, 1125552.01	350	41°	0°	matthew.stuart	10/01/2018	Parent scenario
☐	3 TeV Baseline	Baseline Design, not to be changed.	3 TeV	2494510.09, 1125552.01	350	41°	0°	matthew.stuart	16/01/2018	Parent scenario
☐	380 GeV.IP.CL.V1.0	Optimised with the IP on CERN Land	380 GeV	2494510.09, 1125452.01	390	40°	0°	matthew.stuart	16/01/2018	Parent scenario
☐	3 TeV.IP.CL.V1.0	Optimised with the IP on CERN Land	380 GeV	2494510.09, 1125452.01	390	40°	0°	matthew.stuart	17/01/2018	Parent scenario
☐	Test 3 TeV	Test purposes - can be deleted	380 GeV	2494610.09, 1125452.01	230	48°	0.2°	matthew.stuart	17/01/2018	Parent scenario

EDIT SCENARIO