2011

Penn State AE Senior Thesis

The West Fuala Expansion

Abu Dhabi, PA

Technical Report 2

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Executive Summary:

This project is an expansion of the original Fuala facility which is over a century years old; the expansion will cover an area of 324,403 SF. The Eastern side will be attached to the old facility where there will be an open area between the two structures. The old structure would eventually become an office building while the new facility will take the role of production of this plant.

This Technical report would outline the more details about the project which would include a detailed project schedule, a detailed structural systems estimate, general conditions estimate, LEED evaluation and a Building Information modeling use Evaluation.

In the first technical report a simple schedule was produced to give a brief idea about the how the project would be built. This second report's purpose is to provide a more detailed project schedule which would provide more details regarding the tasks done, the phasing and structural sequenced and so on. The schedule is broken down into 3 major parts: Design development, Package procurement & fabrication, Construction. In addition, tasks are broken down into smaller groups in order to have a better understanding of the sequencing of tasks weather the interest was by trade, area or time.

The Detailed structural Estimate would include as much of the main structural systems as possible. The smaller minor members were omitted while an overall estimate was produced. The plant expansion consists of 3 main structural systems: Cast-in-Place concrete, Precast Concrete and Steel. The building's foundation would be cast-in-place, the envelope/shell of the plant would consist of precast wall panels and precast double Tee beams while steel would be used in the Mezzanine and smaller framing areas.

The General conditions Estimate would be an estimate of the general requirements and conditions costs throughout the project. This would include Personnel costs, Field Office expenses, Temporary facilities and Miscellaneous Costs. The information was brought from the RS means which would then by compared to the actual General conditions cost of the project.

A LEED evaluation is also a part of this report along with a LEED scorecard which would show the extent of how high of a certification would a project be able to achieve. This section would show the results of the scorecard sheet in addition to an evaluation of the categories involved.

Finally, a Building Information Modeling evaluation would be shows. This would explain how BIM was implemented and to what extent it was implemented. It would also address the benefits that the company gained from using this project in addition to what other benefits they could be taken advantage of.

Detailed Project Schedule:

The project schedule is basically as shown on the grant chat shown in Appendix A which illustrates the major phases of construction starting from obtaining the permit until substantial completion. However, since the project is an expansion of an existing plant which runs 24/7, there were a lot of requirements, issues and conditions that had to be done and maintained throughout the project which dictated the flow of the project schedule and caused major changes in the schedule. Maintaining operating plant access, employee entrances, roadways and so on had to be taken into account in planning all of the site improvements to minimize the impacts to daily operations.

The schedule is Technical Assignment 1 provides a broad understanding of how the construction process of the project will take place. This Detailed Project Schedule would show a more comprehensive breakdown of the tasks that will take place starting from the very first stages of Design Development. In that phase, all the drawings and designs would have to be prepared, bid and awarded separately. After which, the second stage can begin which is the package procurement and the fabrication and delivery as required per trade.

The third Stage would be the actual beginning of the construction which would commence by installing a fence and following by bulk excavation. Following the earthwork stage, the process of laying down the foundations and superstructure begins by pouring concrete Mat Foundation, wall strips and column footings. The sequence of placing the plant foundation would take place from south to north starting with the basement, which as mentioned in technical report1 would have an area of 1/4th the main floor and is at the southern end of the building.

After foundations have been placed, erection of the structural system of the building enclosure; from precast walls, columns and slabs; would take place in the following sequence as seen in the schedule: east to west (17 to 23), and south to north (A – U). All the other trades follow the same sequence, except in a few cases such as in Plumbing were there was a Silo Area, Mould Wash, Rail Receiving, Lecithin before the basement and level 1 area were done.

The schedule has been broken down into many divisions in many levels in order to make the schedule readable and understandable with ease.

Notes: Some tasks were not broken down as it would be expected since their details were not as important as the other information that were mentioned (Package Procurement & Engineering: Develop bid package, bid, award, shop drawings, Material Fabrication & Delivery).

Other tasks which have a (“) implies that the sequence is the same as the previous task/trade, and including the details again would be a matter of impractical repetition.

Detailed Structural System Estimate:

The West plant expansion's structural system consists of 3 systems mainly: Precast Concrete, Cast-In-Place Concrete & Steel members. The Foundation of the plant would be a Cast-in-place concrete foundation which includes the Spread Footings, Continuous footing, Foundation Walls and Slab on Grade foundation. The exterior Walls of the plant starting from ground level and upwards would consist of precast walls which do not exceed a width of 12 feet. The precast walls would be set next to each other all around the expansion. The roof of the basement would consist of precast double Tees with a span of 32 feet while the roof of the entire plant (first floor roof) would consist of Double Tees with a 64 feet span. The basement which would have a precast roof would also have a 4" topping slab reinforced with 4x4 @2.9 x W2.9 WWF. The area of the first floor that is over the basement would have a precast structure with 4" concrete topping; the rest of the first floor area (which has no basement) would have a 6" Shrinkage compensating Slab on Grade reinforced with 6x6 W6.0xW6.0 WWF. In addition, the first floor and roof are held by long 24'x24' typical precast columns all over the plant. The Area where most of the structural steel members were used at is the Mezzanine level which can be found over area's B, D, F & H in addition to the framing place of areas I and J. The steel members used in the expansion are mostly Hollow steel structures for the mezzanine and a few Wide flange beams for the roof framing.

The detailed structural estimate in Appendix B shows the breakdown of the costs of the 3 systems mentioned above. The Cast-in Place concrete and precast concrete estimate was placed together while the Steel estimate was placed in another. The estimate was found using a mix of methods which produced the final estimate. The area calculations for the estimate, which can be seen in the concrete tables, were found using Adobe Acrobat 8 Professional area calculation tool. The number of steel members and the precast double tees were found by counting them piece by piece from the drawings provided. The online RS means program, Cost works, was used to transform the total count of steel members and the total volume of concrete into prices that would include all requirements up to Overhead & Profit unless otherwise noted in the assumptions.

The estimate cost turned out to be lower than the actual cost. This can be for many reasons and they are as such: The RS means prices do not reflect the actual cost since each project has its own bid of costs, the exact same members could not be found in the RS means in which the closest option was chosen which could greatly change the costs produces especially in the cast of the steel and precast members, The actual estimate is a comprehensive estimate of all items in its division which is not the case with the estimate since in this case the actual cost of Steel includes all metals in the building while the estimate only reflect the main steel members used.

SYSTEM COST	Estimated	Actual
Concrete	9,649,684	12,735,300
Metals	1,388,187	4,631,919
TOTAL COST	11,037,871	17,367,219

For the Cast-in-Place concrete, the assumptions were as follows:

- The foundation wall is a CIP structure, but the exact details were not found in the RS means in which the estimate provided in Appendix B is actually for a "free-standing wall'
- Most of the members in using in the plant, such as S.O.G. thickness, foundation thickness, footing dimensions and so on could not be found exact in the RS means estimate book in which the closest option was chosen to minimize difference in cost.
- Since counting rebar and WWF in the cast-in-place concrete, in order to find the weight and eventually find the cost, would be a tedious task; it was calculated with a ratio. The only unit estimate within the CIP estimate that had forms, reinforcing steel, concrete place and finishing cost all at once was the 'Free standing wall' mentioned earlier which is in lieu of the foundation wall. The rest of the prices did not include any and as mentioned by Dave Holbert , a guest speaker that came in Thesis class AE 481, and other sources; the material cost of concrete is only around 30% of the total cost which includes the rest of the expenses.

For the Precast Structures:

- The same thing was done with precast regarding picking the option in the RS means that is closest of the member; however, the options were not as close as the CIP estimate so it will have an even less accuracy than the CIP.

- The precast 24’x24’ column cost was estimated since within a typical bay (32’x32’ which can be seen in Figure 1) there are 4 columns and 4 spread footings. However, since each column spans 4 areas, then only ¼ of a column actually holds the load of the typical bay along with 4 other columns. Same thing applies for the spread footings placed below the precast columns. Hence, there is exactly 1 column and 1 spread footing for each typical bay. Through this calculation, the number of columns and spread footing was found by dividing the entire area of the expansion by the typical bay area.

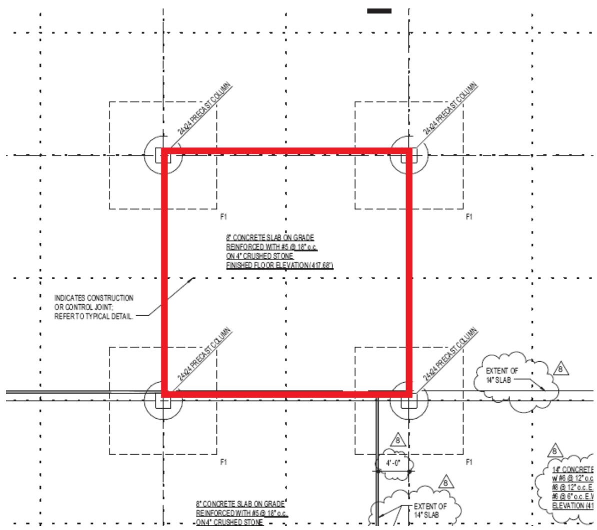


Figure 1 – Typical Bay

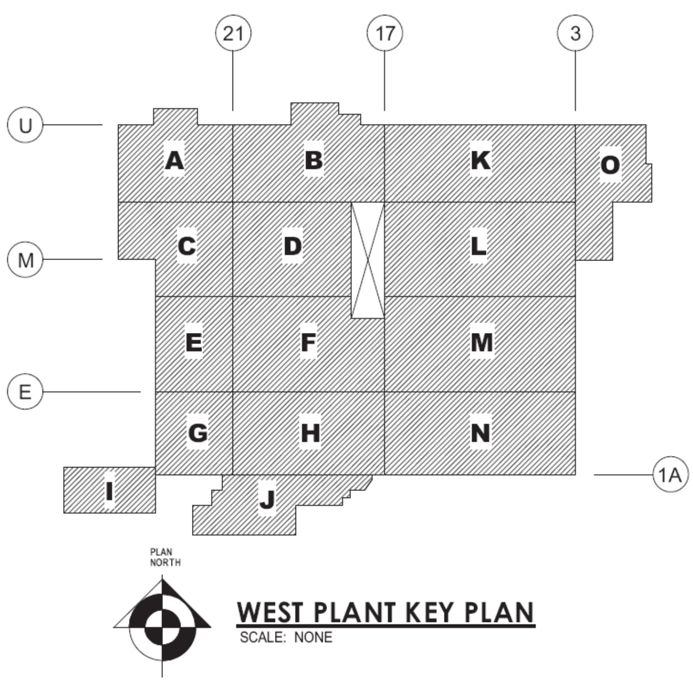
- 24’x24’ Precast columns estimate is not available in the RS means; instead there were only 1 close option which stated “precast column, large, square, up to 24’” which does not describe the precast columns used in the plant. It was also in term of LF so the estimate was done by counting the number of columns which was then multiplied by the height.

As for the Steel estimate:

- Since there no information provided regarding HSS structures in the RS means; the information was brought from the McGill University Website: "http://www.cim.mcgill.ca/~paul/HollowStruct.pdf"
- Most of the actual W steel members used in the plant were not found in the RS means; and so the closest option which would produce a close cost estimate was chosen.
- Since HSS costs are not in the RS means; the cost of the material and its installation was assumed to be like cost of W members. Hence, the ratio of weight of steel of the W members to the cost produced by the RS means Costwork was used to estimate the cost of HHS from its weight.

Since the each area in the plant is different from the other, finding a typical bay and estimating its cost and then estimating the cost compared to the entire building was not possible. Hence, the estimate was done by breaking the plant into 2 zones where so a greater extent, the structural design between the areas in each zone was similar which will produce more accurate results.

Zone A consists of the areas which do not have a basement which are areas A, B, C, D, E, F. Zone B consists of the areas which do have basement which are area G, H, I and J. Within these zones, the areas have different members all over; and so, the details that were chosen to produce the preliminary numbers are the most repetitive and closest option which can be applied to all details chosen. Figure 2 below shows the Areas mentioned above.



General Conditions Estimate:

The General Conditions Estimate is broken down into 2 parts. First of is Personnel Expenses, which includes the main staff working on the project such as the project executive, Senior Project Manager, MEP coordinator, Cost Engineer and so on. The second part of the general conditions estimate would include the Non-personnel expenses which are the Field Office expenses, Temporary facilities and Miscellaneous Costs. An example of such expenses would be project signs, office trailer set up, electric consumption, progress photos and much more as will be seen in Appendix C.

The First part of the estimate which is the primary personnel was created using the organization chart of the Project team where nearly all staff was included in the Primary personnel estimate except for a few members in which their positions were not found in the RS means, which was the source of the estimate.

The non-personnel expenses is a more bigger estimate since it includes more factors that contribute and sum up the general conditions cost. Since not all items in the actual general conditions and general requirements could be found in the RS means and vice versa, a lot of information was closely estimated. Moreover, some estimates were not in the actual general condition in which other things were added instead in order to keep the estimate as close and as realistic as possible.

General Conditions Estimate	
Non Personnel Expenses	$56,410.00
Primary Personnel	$3,542,000.00
TOTAL	$3,598,410.00

GC non Personnel Actual vs. Estimated	
Actual Cost	Estimated Cost
$990,000.00	$596,305.00

The actual 'non Personnel' costs turned out to be much higher than the estimated. There are many factors that contribute to this result; first off which is the fact that not all conditions and requirements were found in the RS means. In addition, most of the costs, even if they were available in the RS means, would have different values and prices. The RS mean's purpose is to provide an approximate of the general conditions cost which is purpose of this section which can be seen in Appendix C.

LEED Evaluation:

The West Fuala Plant Expansion couldn't achieve any LEED certifications through the U.S. Green Building Council (USGBC). Going through information provided from drawings to specification books and from emails to site visits, a rough draft of a LEED Scorecard was developed. The findings show that the project could have been on its way to achieve a Silver LEED certification if all potential points applied.

Sustainable Sites:
The project could earn a minimum of seven points in the category of sustainable sites. While there are two more potential points in storm water design quality control and roof heat island effect. The project only needs to be verified and evaluated for those two potential points. If that was accomplished, they would get a total of 9 points in the category.

Water Efficiency:
The plant expansion is doing great efforts in terms of this category in particular. It's only two points away from achieving the maximum possible points in the category. The project doesn't use any potable water for irrigation. The fixtures in the new expansion can reduce the up to 30% which allow gaining two points. To get the other two in this sub-category, the fixtures in the existing building have to be replaced to get a minimum of 40% reduction of water use in the entire building (including the expansion). Also, the project can employ rainwater harvesting management plan to obtain a 50% water use reduction to get a possible two points in the innovative wastewater technologies sub-category. Unfortunately, the payback period to achieve that is relatively long. So, due to the tight budget, they will have to reconsider spending to employ the requirements to get the four potential points.

Energy & Atmosphere:
This can be the toughest LEED category on the plant. The reason can be obvious, which is the nature of a factory building that has a high consumption of energy and can have some effects on the surrounding environment. Some sub-categories are difficult to achieve because the existing facility has to meet the new requirements of LEED. For example, the existing HVAC equipment has to be verified with the new requirements. Another point is the building can't achieve the enhanced refrigerant management that disallows or limits the use of refrigerants that has global warming effects potentials. That is because of the existing systems that have to be included in the evaluation. On the other hand, there are about 8 potential points. The expansion tends to get points in green power, measurement and verification (with the confirmation of existing system monitoring capabilities), and enhanced commissioning sub-categories.

Materials & Resources:
The expansion can achieve a total of 10 points out of 14 points in the Materials & Resources category. The project can achieve 97% in maintain existing walls, floors, and roof which gives three LEED points. Moreover, the project employed a construction waste management plan that allowed it to achieve a 70% of recycling non-hazardous construction and demolition debris. Recycling a high quantity of steel made a 20%, of the steel total cost, achievable to gain two more points in recycled content sub-category. One more point can be achievable due to the relatively low project cost in the certified wood sub category (small amount of wood can be certified).

Indoor Environmental Quality:
For this category, the expansion couldn't get as many points due to the expansion nature being a factory facility. The expansion lost about seven points in this category. That is because of impracticality and ineffective methods in industrial facilities and production areas; whereas there are five achievable points and three potential points. The first five can be achieved in the following sub-categories: outdoor air delivery monitoring sub-category by incorporating the monitoring and alarm systems as part of BMS with the need of the confirmation of the existing system capability; employing a construction indoor air quality (IAQ) management plan with a relatively small cost; using low-emitting materials (adhesives, sealants, paints, and coatings) in all interior applications. The following sub-categories can get the project 3 more potential points: using low-emitting materials in flooring systems; indoor chemical and pollutant source control by providing entrance floor systems, isolating chemical areas, and filtration of disposal chemical; thermal comfort verification by conducting a thermal comfort survey of the building occupants 6-18 months after occupancy.

Innovation in Design:
The West Fuala Plant Expansion can be considered as an innovative building since it has achieved five out of six points in the innovation in design category. It achieved that by applying the following strategies: using 30% of material cost in the project in materials extracted, harvested, recovered and manufactured within 500 miles of the project location; using 95% of certified wood by the Forest Stewardship Council criteria on the project; maximizing open space; having at least one accredited LEED professional participating on the project team.

Regional Priority Credits:
As mentioned earlier, the nature of this project being a factory facility limited getting some environmental-related points and made some categories/sub-categories hard to fully or partially comply with and this is one of those categories. The project missed four out of six possible points due to the unqualified existing building as well as its location between two independent routes. The only point from the two potential points that tend to be achievable is the associated with storm water quality control, but the site final design still needs to be confirmed.

BIM Evaluation:

Although a lot of benefits and advantages come by default with the use of Building information modeling, the main reason for the use of BIM in this project is mostly for clash detection between the trades.

Initially, the architect created the complete BIM model first in Autodesk Revit Architecture and Revit MEP. It included the architectural, structural and MEP models. This was then converted by the BIM coordinator to .DWG files which was used to create the Navisworks model. Whenever there would be an update, the architect would provide the BIM coordinator with an updated Revit model.

Integration and implementation of BIM for the west plant expansion was conducted by weekly meetings. The BIM coordinator would host a coordination meeting between him and the electrical, mechanical, plumbing, fire protection and process equipment subcontractors. They would then evaluate clashes that the BIM coordinator would report that have been found between their models. The clash report would be performed using Autodesk Navisworks Manage (software).

Each of the subcontractors is responsible for correcting their clashes by next week's meeting. Once a certain area of the building is 'clash-free' where the problems have been addressed, they would then sign off agreeing that that section of the model has been coordinated and if conflicts arise in the field, it is the subcontractors' responsibility to review the model and see who is correct and who is wrong.

BIM will also be used to help the owner coordinate their process equipment. By looking at the model, the owner would be able to see where there are clearance issues with their equipment. At the end of the project, Turner is planning on turning over the model to the owner so that he can use it for facilities management purposes (storage of O&M manuals, warranties, record drawings, shop drawings, etc).

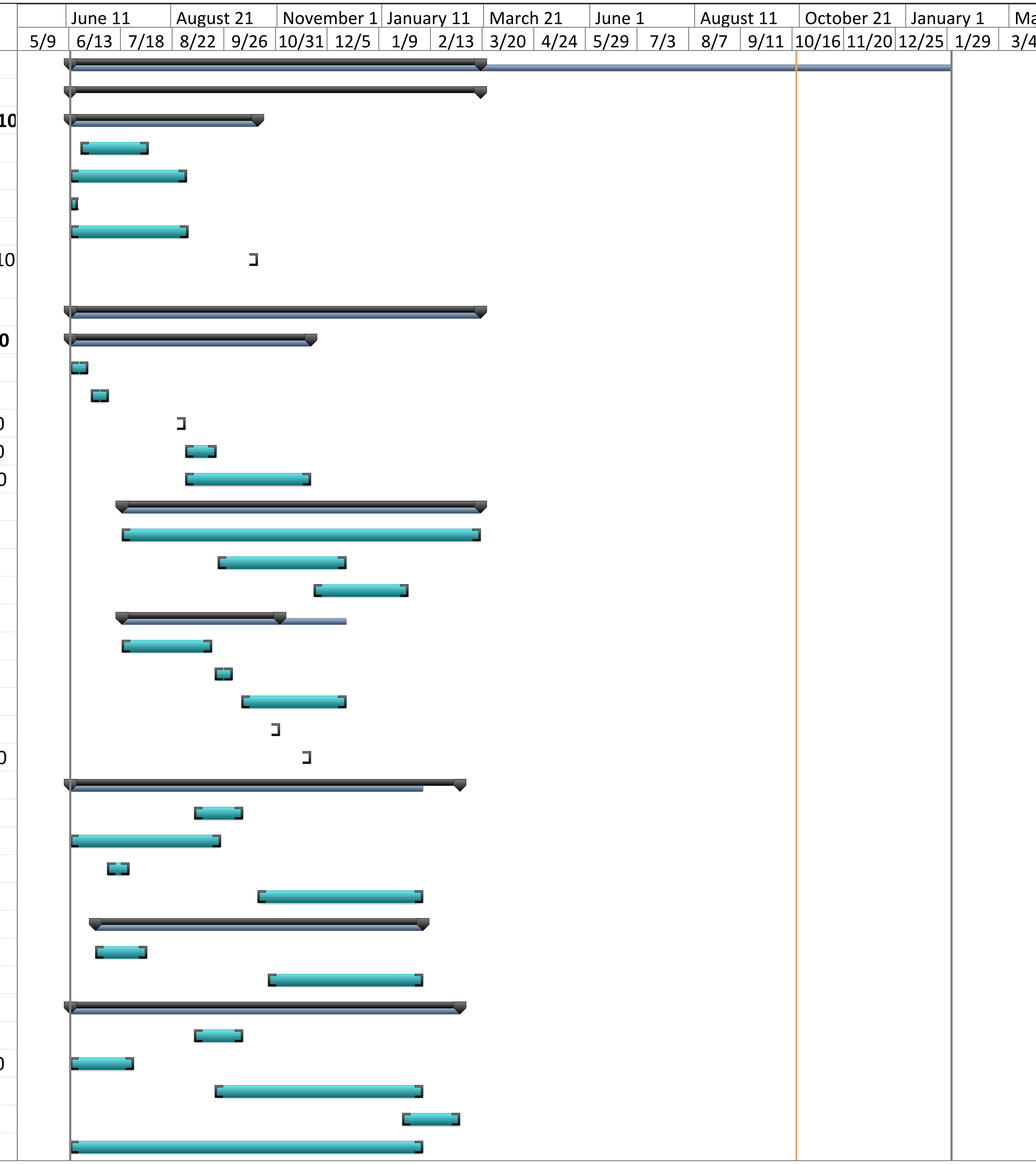
The way BIM was used in this project is for its most basic advantages which are clash detection and solving problems ahead of time. In addition, the way it was implemented was very organized where there were weekly meeting between the main subcontracts and each side had their responsibilities fairs and logically. Another way where BIM was used is Asset management where the owner would be able to use it for the maintenance and operation of the plant.

However, there were other benefits that could have been taken advantage of such as Engineering Analysis which could help improve the project design. For instance it can improve the energy consumption of the plant in addition to the quality of the building services provided. BIM could have also been used to for 'Building Systems Analysis' which is a process that compares the design specification to the actual building performance. With that, the construction faults can be detected and solved.

NB, : The Appendix shows the implemented BIM used and does not show all the other added benefits that could have been taken advantage of.

Appendix A
Detailed project Schedule

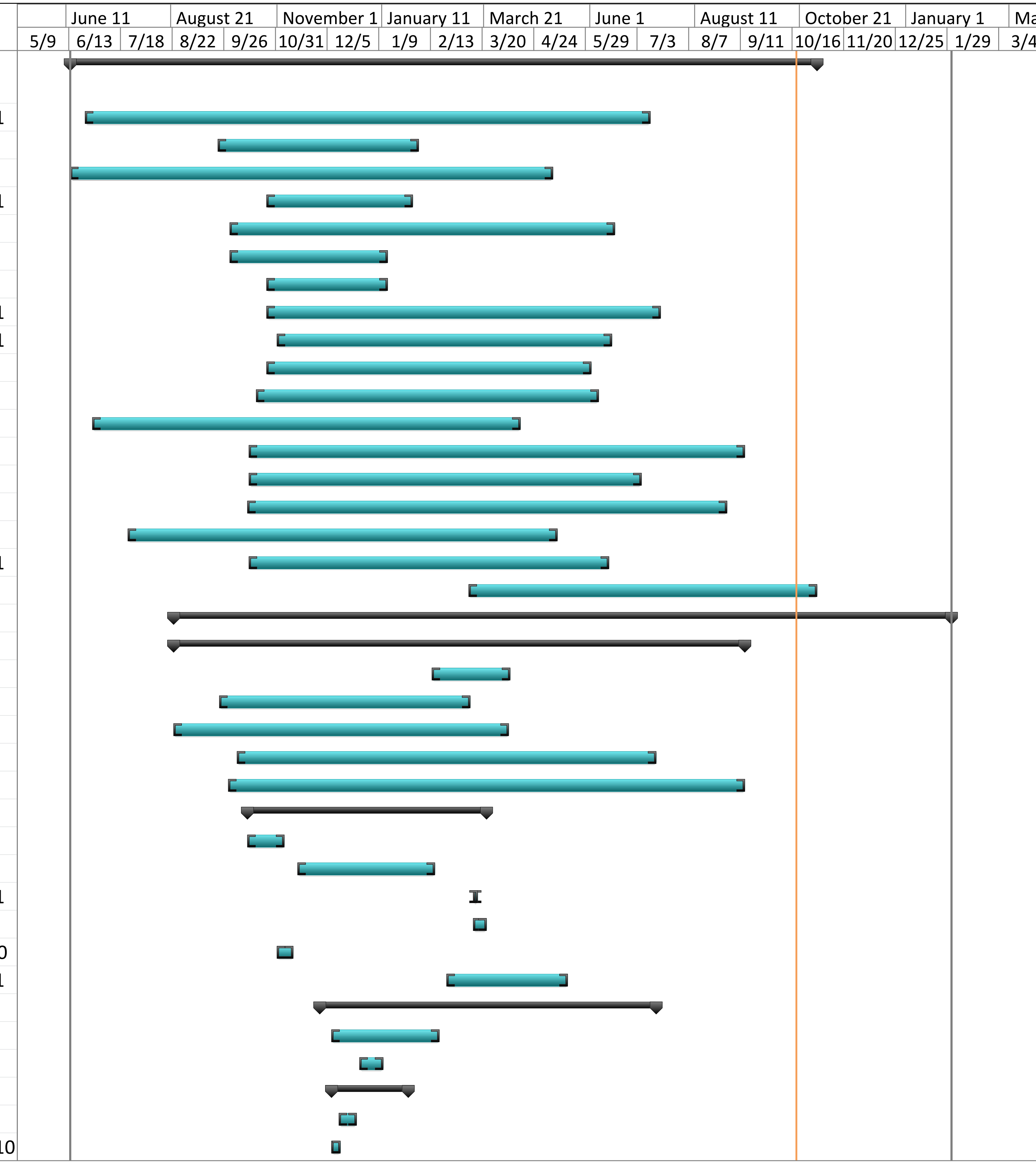
ID		Task Name	Duration	Start	Finish
1		**WEST FUALA PLANT EXPANSION**	**200 days?**	**Mon 6/14/10**	**Fri 3/18/11**
2		**Deisgn Development**	**200 days?**	**Mon 6/14/10**	**Fri 3/18/11**
3		**Fuala Design information & Approvals**	**91 days?**	**Mon 6/14/10**	**Mon 10/18/10**
4		Geotechnical Report, Preliminary and Final	34 days	Mon 6/21/10	Thu 8/5/10
5		Provide Final Site Construction/Bid Drawings	57 days	Mon 6/14/10	Tue 8/31/10
6		Provide exisiting building Drawings	5 days	Mon 6/14/10	Fri 6/18/10
7		Finalize & Sign-off on Floor plans	58 days	Mon 6/14/10	Wed 9/1/10
8		Approval of Design & puchase of Foundation, Mechanical, FP & Electrical systems			Mon 10/18/10
9		**Nutec Design Document Development & Approvals**	**200 days**	**Mon 6/14/10**	**Fri 3/18/11**
10		**Precast Structural Design**	**117 days**	**Mon 6/14/10**	**Tue 11/23/10**
11		Prepare Precast performance bid package	10 days	Mon 6/14/10	Fri 6/25/10
12		Bidding	10 days	Mon 6/28/10	Fri 7/9/10
13		Award Contract			Mon 8/30/10
14		Develop Foundation Loads	15 days	Tue 8/31/10	Mon 9/20/10
15		Prepare precast shop drawings & shell permit package	61 days	Tue 8/31/10	Tue 11/23/10
16		**Architectural Design**	**175 days**	**Mon 7/19/10**	**Fri 3/18/11**
17		Finalize Plant & Syrup Floor Plans	175 days	Mon 7/19/10	Fri 3/18/11
18		Plant Shell Permit package	63 days	Wed 9/22/10	Fri 12/17/10
19		prepare Final Arch Construction Documents	46 days	Fri 11/26/10	Fri 1/28/11
20		**Structural Design**	**77 days**	**Mon 7/19/10**	**Tue 11/2/10**
21		Preliminary Foundation Design	45 days	Mon 7/19/10	Fri 9/17/10
22		Foundation Design / Precast Coordination	10 days	Mon 9/20/10	Fri 10/1/10
23		Plant Shell Permit Package	51 days	Fri 10/8/10	Fri 12/17/10
24		Issue Mezzanine Steel Bid Package			Tue 11/2/10
25		Issue UTB, silo & Rail Shed Steel bid package			Tue 11/23/10
26		**Mechanical Design**	**190 days**	**Mon 6/14/10**	**Fri 3/4/11**
27		Complete underslab piping layout	25 days	Mon 9/6/10	Fri 10/8/10
28		Validate Mecha Design Loads	74 days	Mon 6/14/10	Thu 9/23/10
29		Issue Design/build Refrigeration Systems package	11 days	Fri 7/9/10	Fri 7/23/10
30		Prepare final Mechanical Construction Documents	80 days	Tue 10/19/10	Mon 2/7/11
31		**Fire Protection Design**	**158 days**	**Thu 7/1/10**	**Mon 2/7/11**
32		Validate FP system criteria / FM requirements	25 days	Thu 7/1/10	Wed 8/4/10
33		Final Fire protection Construction Documents	75 days	Tue 10/26/10	Mon 2/7/11
34		**Electrical Design**	**190 days**	**Mon 6/14/10**	**Fri 3/4/11**
35		Complete underslab Electrical layout	25 days	Mon 9/6/10	Fri 10/8/10
36		Validate Electrical Design loads	31 days	Mon 6/14/10	Mon 7/26/10
37		Finalize Electrical Pre-purchase Package	101 days	Mon 9/20/10	Mon 2/7/11
38		Final Electrical Construction Doucments	29 days	Tue 1/25/11	Fri 3/4/11
39		Specifications	171 days	Mon 6/14/10	Mon 2/7/11



Project: Schedule 2
Date: Wed 10/19/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID		Task Name	Duration	Start	Finish
40		**Package Procurement & Engineering: Develop bid package, bid, award, shop drawings, Material Fabrication & Delivery**	**362 days**	**Mon 6/14/10**	**Tue 11/1/11**
41		Earthwork & Site utility Piping	273 days	Thu 6/24/10	Mon 7/11/11
42		Foundation/ Superstructure Concrete	98 days	Wed 9/22/10	Fri 2/4/11
43		Precast Concrete	235 days	Mon 6/14/10	Fri 5/6/11
44		Roofing & Waterproofing	71 days	Mon 10/25/10	Mon 1/31/11
45		Underslab Electrical	187 days	Thu 9/30/10	Fri 6/17/11
46		Underslab Piping	77 days	Thu 9/30/10	Fri 1/14/11
47		Industrial Concrete Floors	60 days	Mon 10/25/10	Fri 1/14/11
48		Structural Steel & Metal Decking	191 days	Mon 10/25/10	Mon 7/18/11
49		Miscellaneous Metals & Stairs	163 days	Mon 11/1/10	Wed 6/15/11
50		insulated metal panels	158 days	Mon 10/25/10	Wed 6/1/11
51		Electrical Equipment Pre-purchase	166 days	Mon 10/18/10	Mon 6/6/11
52		Vertical Transportation	208 days	Tue 6/29/10	Thu 4/14/11
53		Fire protection	240 days	Wed 10/13/10	Tue 9/13/11
54		Plumbing	190 days	Wed 10/13/10	Tue 7/5/11
55		HVAC & Sheetmetal	233 days	Tue 10/12/10	Thu 9/1/11
56		Refrigeration Systems	207 days	Fri 7/23/10	Mon 5/9/11
57		Electrical Systems	174 days	Wed 10/13/10	Mon 6/13/11
58		General Construction package	168 days	Fri 3/11/11	Tue 11/1/11
59		**Construction**	**377 days**	**Mon 8/23/10**	**Tue 1/31/12**
60		**Earthwork**	**277 days**	**Mon 8/23/10**	**Tue 9/13/11**
61		Basement Foundation Wall Backfill	39 days	Mon 2/14/11	Thu 4/7/11
62		Clearing & Grubbing	122 days	Thu 9/23/10	Fri 3/11/11
63		Install Fencing	163 days	Mon 8/23/10	Wed 4/6/11
64		Remove existing parking lot paving/ curbs	204 days	Tue 10/5/10	Fri 7/15/11
65		Grade/ Stone parking lots & Access Roads	250 days	Wed 9/29/10	Tue 9/13/11
66		**Basement**	**116 days**	**Tue 10/12/10**	**Tue 3/22/11**
67		Bulk Excavation	19 days	Tue 10/12/10	Fri 11/5/10
68		Footing/ foundation excavation	67 days	Mon 11/15/10	Tue 2/15/11
69		muck-out unsuitable soil + Regrade / proof-roll subgrade	3 days	Mon 3/14/11	Wed 3/16/11
70		Place vapor barrier & stone	7 days	Mon 3/14/11	Tue 3/22/11
71		Utility building - Bulk Excavation	9 days	Mon 11/1/10	Thu 11/11/10
72		Retaining wall	58 days	Thu 2/24/11	Mon 5/16/11
73		**Foundation / Superstructure Concrete**	**164 days**	**Tue 11/30/10**	**Fri 7/15/11**
74		Basment foundation	53 days	Wed 12/8/10	Fri 2/18/11
75		36" Matt Foundations at Paste (20 - 18 / D - E)	12 days	Mon 12/27/10	Tue 1/11/11
76		**Retaining wall footing**	**38 days**	**Wed 12/8/10**	**Fri 1/28/11**
77		24' along E-line (90')	10 days	Mon 12/13/10	Fri 12/24/10
78		24' along 23-line (128')	4 days	Wed 12/8/10	Mon 12/13/10



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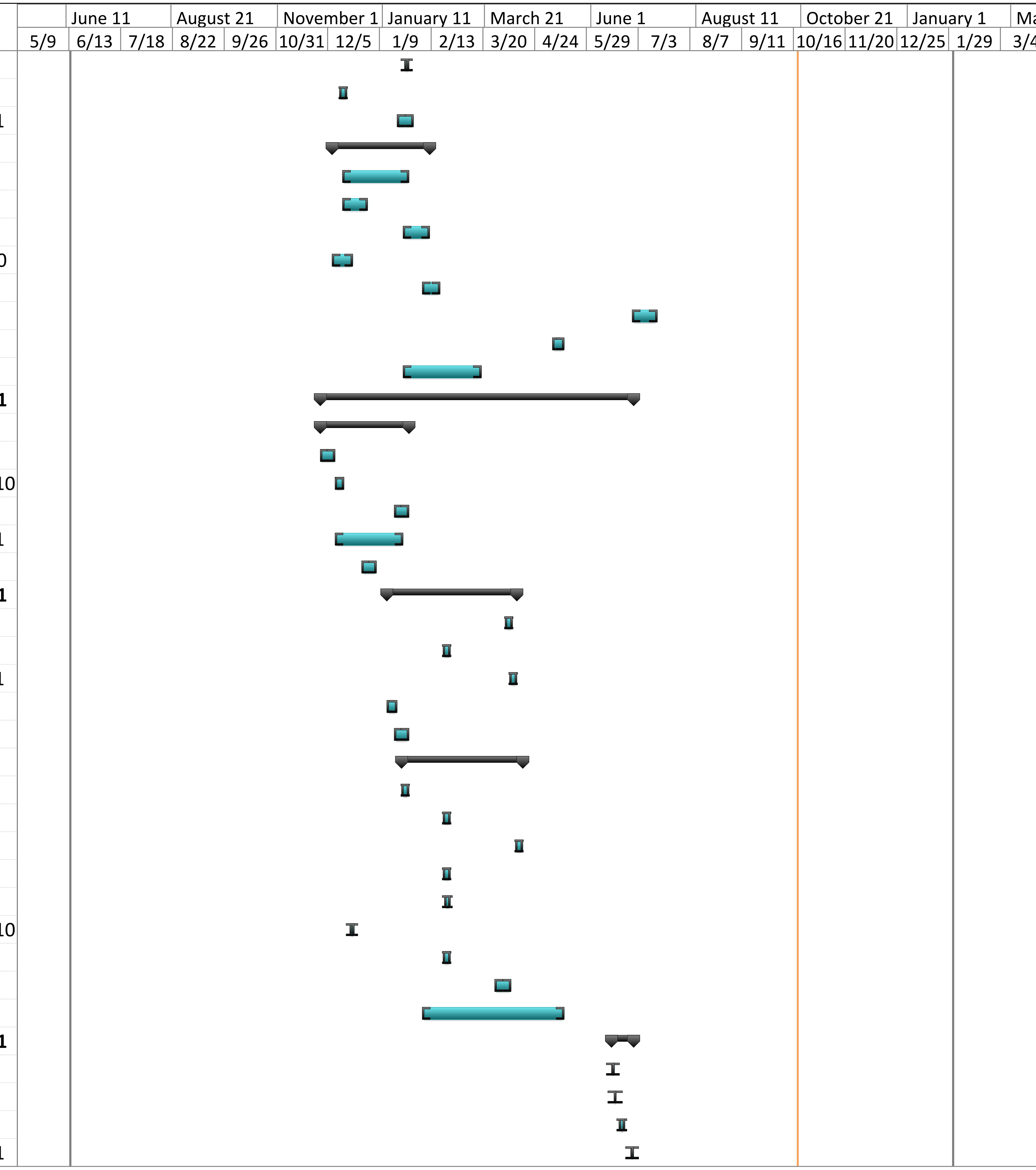
Date: Wed 10/19/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

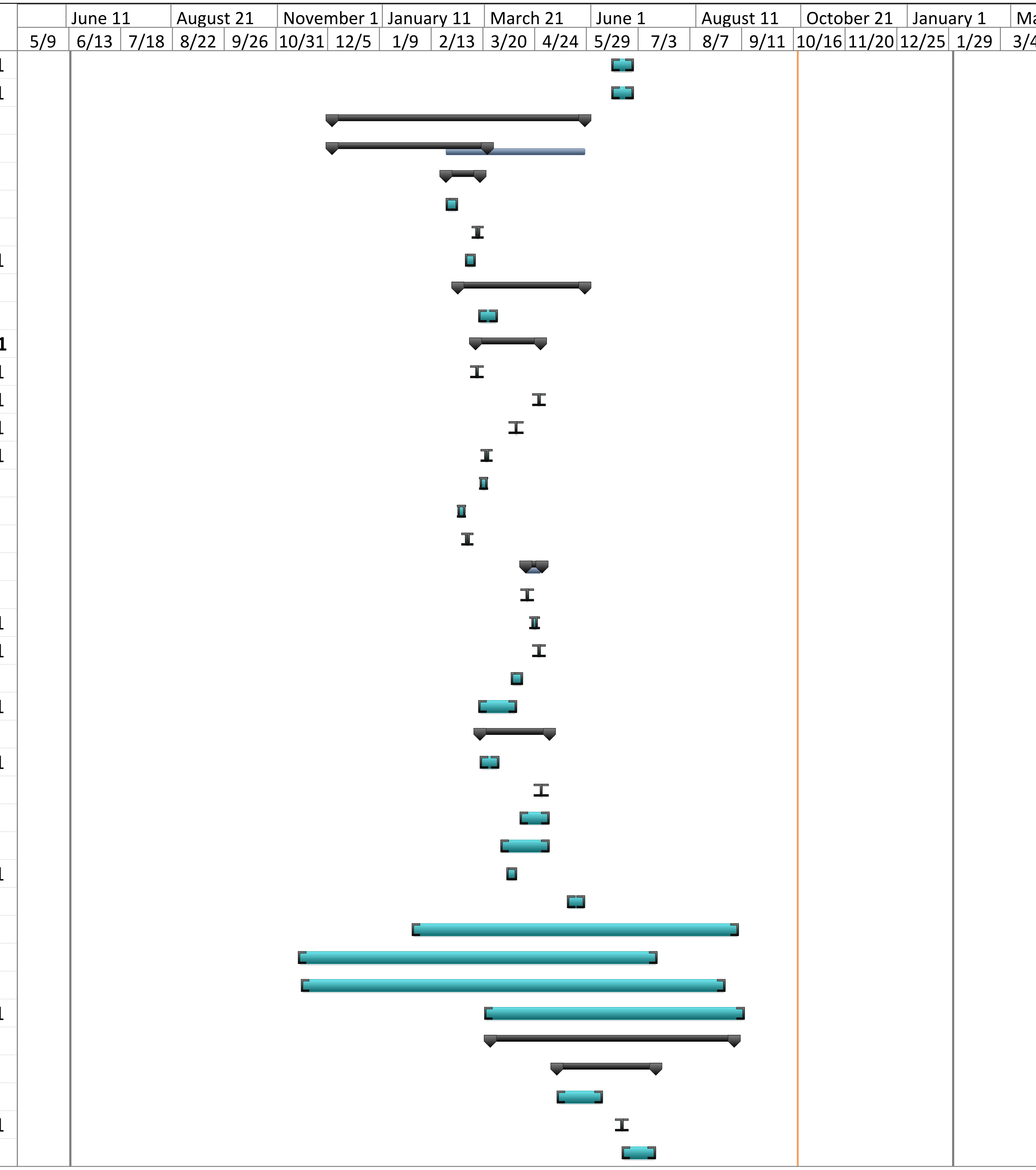
ID	Task Name	Duration	Start	Finish
79	24' along 18 @ C (26')	3 days	Wed 1/26/11	Fri 1/28/11
80	10' along A/1a (100')	5 days	Mon 12/13/10	Fri 12/17/10
81	18" Matt Foundation at Link (17-18 / A-C)	7 days	Fri 1/21/11	Mon 1/31/11
82	**Basement Foundation Walls**	**48 days**	**Wed 12/8/10**	**Fri 2/11/11**
83	along E-line (320')	33 days	Wed 12/15/10	Fri 1/28/11
84	along 23-line (128')	13 days	Wed 12/15/10	Fri 12/31/10
85	along 18 & C (126')	14 days	Tue 1/25/11	Fri 2/11/11
86	along A/1a (224')	10 days	Wed 12/8/10	Tue 12/21/10
87	Basement Interior Footings & Pits	10 days	Mon 2/7/11	Fri 2/18/11
88	Rail Shed foundation Wall (21.5, UU, 19.5)	13 days	Wed 6/29/11	Fri 7/15/11
89	Block Loading Dock footing & Foundation Walls	6 days	Fri 5/6/11	Fri 5/13/11
90	Utility Building: Footings, Retaining Walls, Interior Footing	39 days	Tue 1/25/11	Fri 3/18/11
91	**Main Building Foundations**	**152 days**	**Tue 11/30/10**	**Wed 6/29/11**
92	**[17-24 / M-U]**	**44 days**	**Tue 11/30/10**	**Fri 1/28/11**
93	North Wall Strip & Column Footing (17-24)	8 days	Tue 11/30/10	Thu 12/9/10
94	West wall Strip & Column Footing (M-U)	4 days	Fri 12/10/10	Wed 12/15/10
95	Interior Column Footing (17-24 / M - U)	8 days	Wed 1/19/11	Fri 1/28/11
96	North Wall - Perimeter fdn wall (17 - 24)	32 days	Fri 12/10/10	Mon 1/24/11
97	West Wall - Perimeter fdn Wall (M-U)	8 days	Tue 12/28/10	Thu 1/6/11
98	**[H.9-M]**	**62 days**	**Fri 1/14/11**	**Mon 4/11/11**
99	West Wall Strip & Column Footing	5 days	Mon 4/4/11	Fri 4/8/11
100	East Wall Strip & Column Footing	5 days	Mon 2/21/11	Fri 2/25/11
101	West Wall - Perimeter fdn Wall	3 days	Thu 4/7/11	Mon 4/11/11
102	East Wall - Perimeter fdn Wall	5 days	Fri 1/14/11	Thu 1/20/11
103	Interior Column Footing	8 days	Wed 1/19/11	Fri 1/28/11
104	**[E-H.9]**	**60 days**	**Mon 1/24/11**	**Fri 4/15/11**
105	West Wall Strip & Column Footing	5 days	Mon 1/24/11	Fri 1/28/11
106	East Wall Strip & Column Footing	5 days	Mon 2/21/11	Fri 2/25/11
107	Interior Column Footing Main bldg	5 days	Mon 4/11/11	Fri 4/15/11
108	West Wall - Perimeter fdn Walls	5 days	Mon 2/21/11	Fri 2/25/11
109	East Wall - Perimeter fdn Wall	4 days	Tue 2/22/11	Fri 2/25/11
110	Link Perimeter Grade beams (Q)	3 days	Mon 12/20/10	Wed 12/22/10
111	Link Perimeter Grade beams (F)	5 days	Mon 2/21/11	Fri 2/25/11
112	Office Building Expansion Foundations	9 days	Mon 3/28/11	Thu 4/7/11
113	Foundation Wall Backfill	70 days	Mon 2/7/11	Fri 5/13/11
114	**@ 11-line: Remove , Excavate, FRP, Pour in-fill**	**11 days**	**Wed 6/15/11**	**Wed 6/29/11**
115	Sawcut/ Remove Slab	2 days	Wed 6/15/11	Thu 6/16/11
116	Excavate for foundation	1 day	Fri 6/17/11	Fri 6/17/11
117	Form, Rebar & pour Foundation	4 days	Mon 6/20/11	Thu 6/23/11
118	Pour Slab in-fill	2 days	Tue 6/28/11	Wed 6/29/11



Project: Schedule 2
Date: Wed 10/19/11

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress

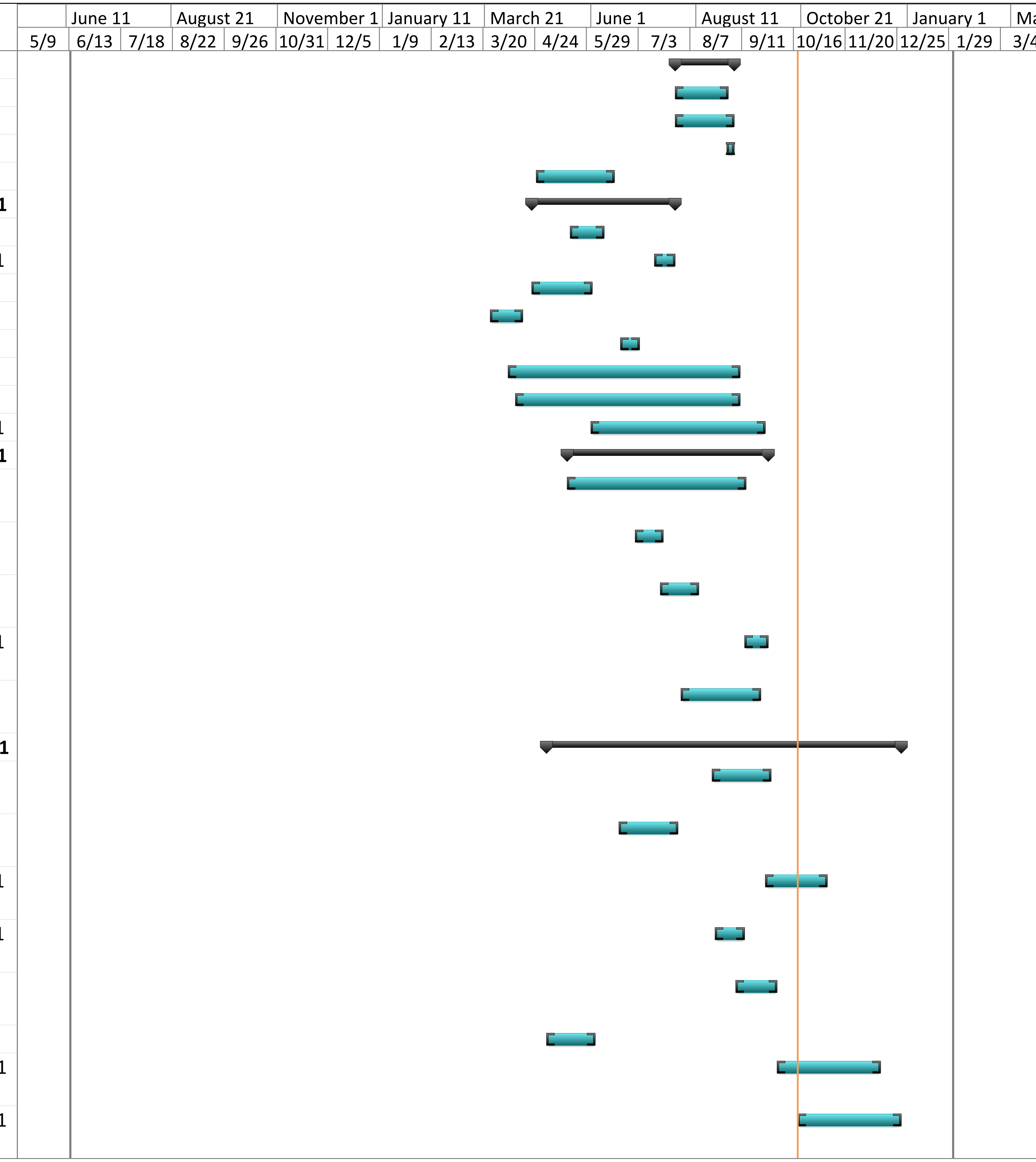
ID	Task Name	Duration	Start	Finish
119	@ 12-line: Remove , Excavate, FRP, Pour in-fill	11 days	Wed 6/15/11	Wed 6/29/11
120	@ 8-line: Remove , Excavate, FRP, Pour in-fill	11 days	Wed 6/15/11	Wed 6/29/11
121	**Precast Concrete**	**123 days**	**Wed 12/8/10**	**Fri 5/27/11**
122	**Basement / Main building Precase (A - E)**	**75 days**	**Wed 12/8/10**	**Tue 3/22/11**
123	**Basement**	**17 days**	**Wed 2/23/11**	**Thu 3/17/11**
124	Interior precast columns (29)	6 days	Wed 2/23/11	Wed 3/2/11
125	Interior Precast Walls	3 days	Tue 3/15/11	Thu 3/17/11
126	Precast Elevated Slab - over basement	5 days	Tue 3/8/11	Mon 3/14/11
127	**Main Building**	**62 days**	**Thu 3/3/11**	**Fri 5/27/11**
128	Precast Roof (2a - E & 17-23)	9 days	Thu 3/17/11	Tue 3/29/11
129	**Interior Precast Wall**	**32 days**	**Tue 3/15/11**	**Wed 4/27/11**
130	(A - E & 17 - 23)	2 days	Tue 3/15/11	Wed 3/16/11
131	(E - H.9 / 17 - 23)	2 days	Tue 4/26/11	Wed 4/27/11
132	(H.9 - P/ 17 - 23)	1 day	Mon 4/11/11	Mon 4/11/11
133	(P - U / 17 - 23)	3 days	Mon 3/21/11	Wed 3/23/11
134	Precast Walls (17 - 18 & C - E)	3 days	Fri 3/18/11	Tue 3/22/11
135	Interior Columns (18 - 23 & C - E)	3 days	Thu 3/3/11	Mon 3/7/11
136	Precast Walls (on 23 / A - E)	3 days	Tue 3/8/11	Thu 3/10/11
137	**Precast (E - H.9) "**	**9 days**	**Mon 4/18/11**	**Thu 4/28/11**
138	Walls (on 18 / E - L)	2 days	Mon 4/18/11	Tue 4/19/11
139	Interior Columns (18 - 23 & E - H.9)	2 days	Fri 4/22/11	Mon 4/25/11
140	Precast Walls (on 23 & E - H.9)	2 days	Tue 4/26/11	Wed 4/27/11
141	Precast (H.9 - P) "	6 days	Fri 4/8/11	Fri 4/15/11
142	Precast (P - U) "	18 days	Thu 3/17/11	Mon 4/11/11
143	**Precast Roof & Install RTU (18 - 23)**	**33 days**	**Fri 3/18/11**	**Tue 5/3/11**
144	(A - E)	9 days	Fri 3/18/11	Wed 3/30/11
145	(E - H.9)	1 day	Thu 4/28/11	Thu 4/28/11
146	(H.9 - P)	14 days	Thu 4/14/11	Tue 5/3/11
147	(P - U)	23 days	Fri 4/1/11	Tue 5/3/11
148	Courtyard - Precast Walls / Roof	5 days	Tue 4/5/11	Mon 4/11/11
149	Office Building Precast	10 days	Mon 5/16/11	Fri 5/27/11
150	Roofing & Waterproofing	159 days	Mon 1/31/11	Thu 9/8/11
151	Underslab Electric	175 days	Mon 11/15/10	Fri 7/15/11
152	Underslab Piping	205 days	Wed 11/17/10	Tue 8/30/11
153	Industrial Concrete Floors: Form, Rebar, Pour	126 days	Mon 3/21/11	Mon 9/12/11
154	**Structural Steel & Metal Decking**	**117 days**	**Fri 3/25/11**	**Mon 9/5/11**
155	**Silo Building**	**49 days**	**Mon 5/9/11**	**Thu 7/14/11**
156	Steel framing & Roof joists	23 days	Mon 5/9/11	Wed 6/8/11
157	Metal Decking	2 days	Tue 6/21/11	Wed 6/22/11
158	IMP Girts & Channels	17 days	Wed 6/22/11	Thu 7/14/11



Project: Schedule 2
Date: Wed 10/19/11

Task | Project Summary | Inactive Milestone | Manual Summary Rollup | Deadline
Split | External Tasks | Inactive Summary | Manual Summary | Progress
Milestone | External Milestone | Manual Task | Start-only
Summary | Inactive Task | Duration-only | Finish-only

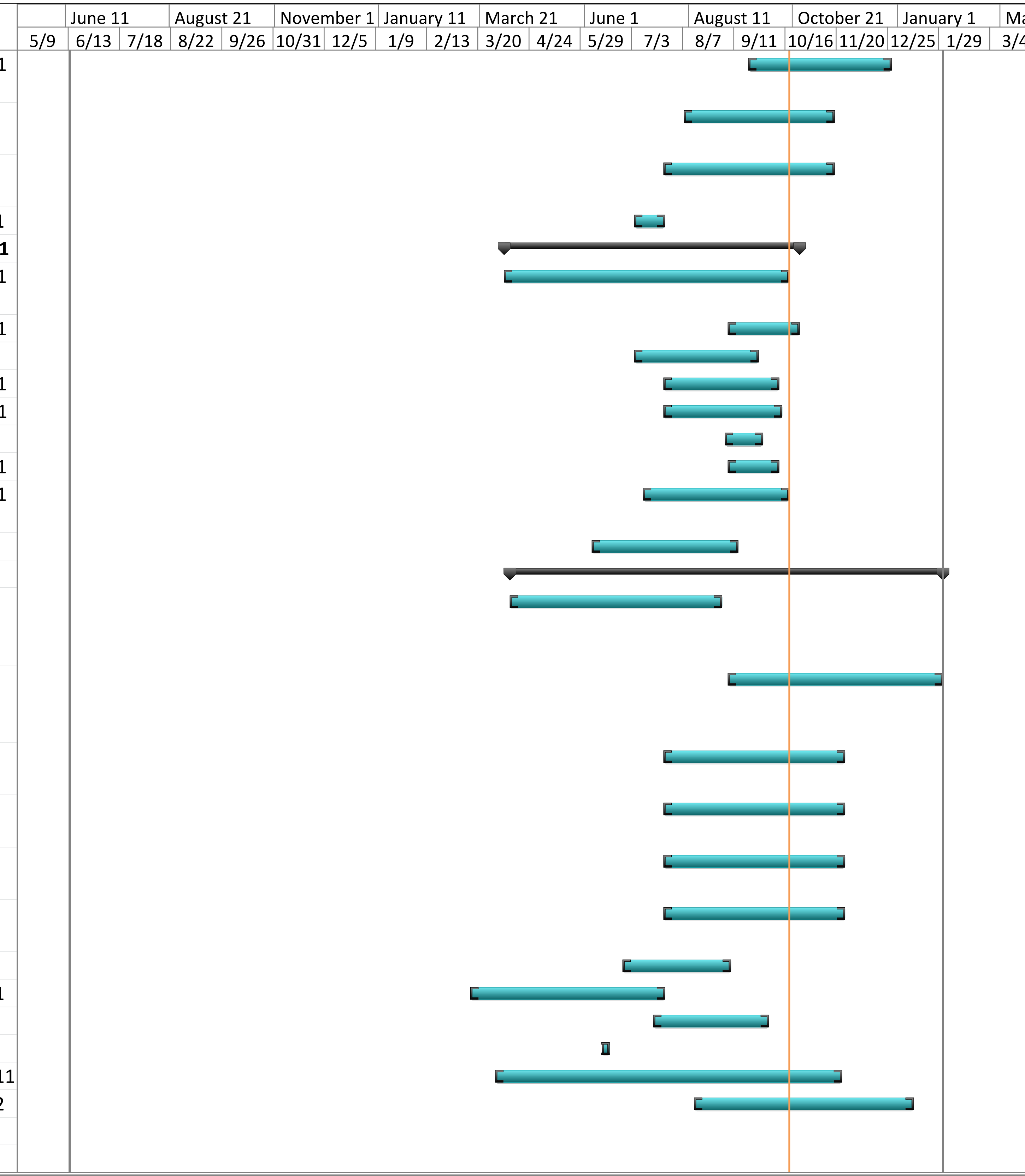
ID		Task Name	Duration	Start	Finish
159		**Rail Receiving**	**28 days**	**Thu 7/28/11**	**Mon 9/5/11**
160		Steel Framing	26 days	Thu 7/28/11	Thu 9/1/11
161		Joists & metal Decking	28 days	Thu 7/28/11	Mon 9/5/11
162		IMP Girts & Channels	3 days	Thu 9/1/11	Mon 9/5/11
163		Basement Mezzanine Steel & Deck (18 - 19 / A.3 - C)	39 days	Mon 4/25/11	Thu 6/16/11
164		**Install Mezzanine Steel & Metal Deck**	**69 days**	**Fri 4/22/11**	**Wed 7/27/11**
165		(A - H.9)	17 days	Wed 5/18/11	Thu 6/9/11
166		(C - E / 20)	10 days	Thu 7/14/11	Wed 7/27/11
167		(H.9 - U)	29 days	Fri 4/22/11	Wed 6/1/11
168		Utility Building Steel Erection, deck & detailing	16 days	Fri 3/25/11	Fri 4/15/11
169		Elevated Walkway Steel, Deck & Rails	10 days	Tue 6/21/11	Sun 7/3/11
170		Miscllaneous Metals & Stairs	113 days	Wed 4/6/11	Fri 9/9/11
171		Insulated Metal panels	110 days	Mon 4/11/11	Fri 9/9/11
172		Vertical Transportation	84 days	Wed 6/1/11	Mon 9/26/11
173		**Fire protection**	**98 days**	**Mon 5/16/11**	**Wed 9/28/11**
174		Basement: dry Sprinkler hangers, Mains & branches, Drops & heads, Valve assembly	87 days	Mon 5/16/11	Tue 9/13/11
175		Under Mezz: dry Sprinkler hangers, Mains & branches, Drops & heads, Valve assembly	13 days	Fri 7/1/11	Tue 7/19/11
176		Silo: dry Sprinkler hangers, Mains & branches, Drops & heads, Valve assembly	20 days	Mon 7/18/11	Fri 8/12/11
177		Rail Shed: dry Sprinkler hangers, Mains & branches, Drops & heads, Valve assembly	12 days	Tue 9/13/11	Wed 9/28/11
178		First Floor: dry Sprinkler hangers, Mains & branches, Drops & heads, Valve assembly	40 days	Mon 8/1/11	Fri 9/23/11
179		**Plumbing**	**172 days**	**Mon 5/2/11**	**Tue 12/27/11**
180		Silo Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim	30 days	Mon 8/22/11	Fri 9/30/11
181		Mould Wash Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim	30 days	Mon 6/20/11	Fri 7/29/11
182		Rail Receiving Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim	30 days	Tue 9/27/11	Mon 11/7/11
183		Lecithin Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim	14 days	Wed 8/24/11	Mon 9/12/11
184		Basement Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim	20 days	Wed 9/7/11	Tue 10/4/11
185		Level 1 Floor Drainage	25 days	Mon 5/2/11	Fri 6/3/11
186		(A - E) Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim; In-wall plumbing	50 days	Wed 10/5/11	Tue 12/13/11
187		Syrup Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim; In-wall plumbing	50 days	Wed 10/19/11	Tue 12/27/11



Project: Schedule 2
Date: Wed 10/19/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID	Task Name	Duration	Start	Finish
188	(E - H.9) Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim; In-wall plumbing	70 days	Wed 9/21/11	Tue 12/27/11
189	(H.9 - P) Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim; In-wall plumbing	75 days	Mon 8/8/11	Fri 11/18/11
190	(P - U) Area: Install Roof Drains &Storm Piping; Plumbing Branch Runouts; Branch Insulation; Fixtures and Trim; In-wall plumbing	85 days	Mon 7/25/11	Fri 11/18/11
191	Install & Connect DW Booster Pumps, CA Dryer & Accessories	15 days	Tue 7/5/11	Mon 7/25/11
192	**HVAC"**	**144 days**	**Thu 4/7/11**	**Tue 10/25/11**
193	Basement: Hangers & Pipe Rack Support, Install utilities on Pipe Racks; Piping & DuctWork; Unit cooler Pipe Connections; branches	139 days	Thu 4/7/11	Tue 10/18/11
194	(A - E): HVAC Pipe Mains & Branches + Insulation	35 days	Wed 9/7/11	Tue 10/25/11
195	UTB: HVAC Pipe Mains & Branches + Insulation	61 days	Tue 7/5/11	Tue 9/27/11
196	(E - H.9): HVAC Pipe Mains & Branches + Insulation	57 days	Mon 7/25/11	Tue 10/11/11
197	(H.9 - P): HVAC Pipe Mains & Branches + Insulation	59 days	Mon 7/25/11	Thu 10/13/11
198	Install Unit heaters, In-Wall exhaust Fans,	20 days	Mon 9/5/11	Fri 9/30/11
199	Piping & DuctWork Connections - RTU's	25 days	Wed 9/7/11	Tue 10/11/11
200	Install & Connect heat Exchangers, Cooling Tower, Blower Coil unit, Fan Coil Units, Exhaust Fans	72 days	Mon 7/11/11	Tue 10/18/11
201	Ductwork Mains & Branches	72 days	Mon 6/6/11	Tue 9/13/11
202	**Electrical Systems"**	**212 days**	**Mon 4/11/11**	**Tue 1/31/12**
203	Basement: Electrical Hangers & Supports; Lighting & Power; Trim-out Electrical Devices; Panel & Transformer Terms; Unit Cooler Power Connections	105 days	Mon 4/11/11	Fri 9/2/11
204	UTB: Electrical Hangers & Supports; Lighting & Power; Trim-out Electrical Devices; Panel & Transformer Terms; Unit Cooler Power Connections	105 days	Wed 9/7/11	Tue 1/31/12
205	(A - E): Electrical Hangers & Supports; Lighting & Power Conduit + Wiring; Panel & Transformer Terms; Light fixtures	90 days	Mon 7/25/11	Fri 11/25/11
206	(E - H.9):Electrical Hangers & Supports; Lighting & Power Conduit + Wiring; Panel & Transformer Terms; Light fixtures	90 days	Mon 7/25/11	Fri 11/25/11
207	(H.9 - P): Electrical Hangers & Supports; Lighting & Power Conduit + Wiring; Panel & Transformer Terms; Light fixtures	90 days	Mon 7/25/11	Fri 11/25/11
208	(P - U):Electrical Hangers & Supports; Lighting & Power Conduit + Wiring; Panel & Transformer Terms; Light fixtures	90 days	Mon 7/25/11	Fri 11/25/11
209	Parking Lots: Site Light fixtures, U.Power / Light	54 days	Mon 6/27/11	Thu 9/8/11
210	Masonry	95 days	Tue 3/15/11	Mon 7/25/11
211	Landscaping	57 days	Mon 7/18/11	Tue 10/4/11
212	Fuala Equipment Installation	5 days	Mon 6/13/11	Fri 6/17/11
213	Utility Shutdowns & Tie-ins	169 days	Fri 4/1/11	Wed 11/23/11
214	Equipment/ System Start-up & Commissioning	108 days	Mon 8/15/11	Wed 1/11/12
215				
216				



Project: Schedule 2
Date: Wed 10/19/11

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress

Appendix B

Detailed Structural System Estimate

CONTINUOUS FOOTING	Wall Footing Thickness	Wall Footing Width	Perimeter	Total Volume (CUFT)	Total Volume (CY)
Zone A (A,B,C,D,E,F)	1	6	1041	6246	231.3333333
Zone B (G,H,I,J)	2	10	1474	29480	1091.851852
TOTAL				35726	1323.185185

FOUNDATION WALL	Thickness	Height	Perimieter	Total Volume (CUFT)	Total Volume (CY)
Zone A	1	4.5	1041	4684.5	173.5
Zone B	1.5	28.67	1474	63389.37	2347.754444
TOTAL				68073.87	2521.254444

PRECAST WALLS	perimeter	width	Count	Height	SF
Exterior Walls	2515	12	209.5833333	32.5	81737.5

S.O.G. FOUNDATION	Thickness	Area	Total Volume (CUFT)	Total Volume (CY)
Zone A	0.50	178559	89279.5	3306.648148
Zone B	0.67	60822	40548	1501.777778
TOTAL			129827.5	4808.425926

PRECAST Double Tee Count	Area G	Area H	Mezz B	Roof Overall
Length = 32'	48	72	0	0
length = 64'	0	0	15	255

CONCRETE TOPPING (S.O.G.)	Thickness	Area	Total Volume (CUFT)	Total Volume (CY)
Mezz	0.25	31882	7970.5	295.2037037
Zone B	0.33333	49765	16588.16745	614.3765722
TOTAL			24558.66745	909.5802759

Concrete on composite Slab	thickness	area	Total Volume (CUFT)	Total Volume (CY)
Area I	0.5	11650	5825	215.7407407
Area J	0.5	49762	24881	921.5185185
Mezz B	0.5	11833	5916.5	219.1296296
TOTAL			36622.5	1356.388889

INTERIOR PRECAST COLUMNS	1 per 32'x32' = 1024 SQFT			
	Area	Typical Bay = 32' x 32'	PRECAST COLUMN Count	Rounded
Zone A - First Floor	178559	1024	174.3740234	175
Zone B - First Floor	60822	1024	59.39648438	60
Zone B - basement	60822	1024	59.39648438	60

SPREAD FOOTINGS	1 per 32'x32' = 1024 SQFT			
	Volume of Footing	Like Precast column Count	Total Volume (CUFT)	Total Volume (CY)
Zone A	288	175	50400	1866.666667
Zone B	588	60	35280	1306.666667
TOTAL			85680	3173.333333

STEEL MEMBERS					
Beam Type	Count	Length	Total Length	Weight	Total Weight
HSS 10X6X1/4	23	16	368	25.82	9501.76
HSS 12x12x3/8	23	30	690	78.52	54178.8
HSS 12X12X5/16	2	30	60	65.87	3952.2
HSS 20X12X1/2	52	32	4894	103.3	505550.2
HSS 20X12X5/8	20	32	640	123.72	79180.8
HSS 28X24X1/2	3	32	448	169.89	76110.72
HSS 32X24X5/8	1	32	96	225.8	21676.8
W 12X26	4	25	100	26	2600
W 14x109	28	30	840	109	91560
W 21X44	89	25	120	44	5280
W 24X55	4	25	100	55	5500
W 27X84	7	25	175	84	14700
W 30X108			378	108	40824
W 30X90	3	20	60	90	5400
W 33X118	8	25	200	118	23600
W 36X170	2	32	64	170	10880
TOTAL WEIGHT W					200344
TOTAL WEIGHT HSS					750151.28

TOTAL Cast-In Place Concrete (CY)	**380488.5375**
TOTAL PRECAST COLUMN COUNT	295
TOTAL PRECAST DOUBE T COUNT (32')	120
TOTAL PRECAST DOUBE T COUNT (64')	270

STEEL COST SUMMARY		
	Weight	cost
W	200344	292600
HSS	750151	1095587
Ratio	1	1.46
TOTAL COST		1,388,187.00

CONCRETE COST SUMMARY	
Precast Cost	4,744,507.00
CIP cost	4,905,177.00
TOTAL CONCRETE	9,649,684.00

SYSTEM COST	Estimated	Actual
Concrete	9,649,684	12,735,300.00
Metals	1,388,187	4,631,919.00
TOTAL COST	11,037,871	17,367,219.00

Cost Estimate Report
CostWorks®
RSMeans

Unit Detail Report

Year 2011 Quarter 3

Prepared By:
Jaafar Al Aidaroos
PSU

Structural Estimate

Date: 19-Oct-11

Line Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
Division 03 Concrete							
033053404200			Structural concrete, in place, free-standing wall (3000 psi), 8" thick x 8' high, includes forms(4 uses), reinforcing steel, concrete, placing and finishing	2521	C.Y.	$461.94	$1,164,550.74
033105702150			Structural concrete, placing, continuous footing, deep, pumped, includes strike off & consolidation, excludes material	1323	C.Y.	$29.01	$38,380.23
033105702650			Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes strike off & consolidation, excludes material	3173	C.Y.	$30.93	$98,140.89
033105704300			Structural concrete, placing, slab on grade, direct chute, up to 6" thick, includes strike off & consolidation, excludes material	4808	C.Y.	$24.10	$115,872.80
033105704300			Structural concrete, placing, slab on grade, direct chute, up to 6" thick, includes strike off & consolidation, excludes material	910	C.Y.	$24.10	$21,931.00
033105704300			Structural concrete, placing, slab on grade, direct chute, up to 6" thick, includes strike off & consolidation, excludes material	1356	C.Y.	$24.10	$32,679.60
034105150350			Precast column, large, square, to 24' high, 3000 psi, includes material only	8850	L.F.	$275.03	$2,434,015.50
034133601350			Precast tees, double, floor, 30' span, 18" x 8' wide, prestressed	120	Ea.	$2,886.75	$346,410.00
034133601500			Precast tees, double, floor, 60' span, 32" x 10' wide, prestressed	15	Ea.	$7,036.64	$105,549.60
034133602450			Precast tees, double, roof, 60' span, 32" x 10' wide, prestressed	255	Ea.	$6,656.01	$1,697,282.55
034513501250			Precast wall panel, smooth, gray, for exposed aggregate, add	81438	S.F.	$1.98	$161,247.24
Division 03 Concrete Subtotal							**$6,216,060.15**

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Cost Estimate Report CostWorks RSMeans

Unit Detail Report

Year 2011 Quarter 3

Prepared By:
Jaafar Al Aidaroos
PSU

Steel Estimate

Date: 19-Oct-11

Line Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
Division 05 Metals							
051223751500			Structural steel member, 100-ton project, 1 to 2 story building, W12x26, A992 steel, shop fabricated, incl shop primer, bolted connections	100	L.F.	$44.92	$4,492.00
051223752320			Structural steel member, 100-ton project, 1 to 2 story building, W14x43, A992 steel, shop fabricated, incl shop primer, bolted connections	120	L.F.	$69.17	$8,300.40
051223752380			Structural steel member, 100-ton project, 1 to 2 story building, W14x90, A992 steel, shop fabricated, incl shop primer, bolted connections	60	L.F.	$135.95	$8,157.00
051223752500			Structural steel member, 100-ton project, 1 to 2 story building, W14x120, A992 steel, shop fabricated, incl shop primer, bolted connections	200	L.F.	$177.17	$35,434.00
051223752500			Structural steel member, 100-ton project, 1 to 2 story building, W14x120, A992 steel, shop fabricated, incl shop primer, bolted connections	64	L.F.	$177.17	$11,338.88
051223753900			Structural steel member, 100-ton project, 1 to 2 story building, W18x55, A992 steel, shop fabricated, incl shop primer, bolted connections	100	L.F.	$87.91	$8,791.00
051223753960			Structural steel member, 100-ton project, 1 to 2 story building, W18x86, A992 steel, shop fabricated, incl shop primer, bolted connections	175	L.F.	$130.99	$22,923.25
051223753980			Structural steel member, 100-ton project, 1 to 2 story building, W18x106, A992 steel, shop fabricated, incl shop primer, bolted connections	840	L.F.	$158.59	$133,215.60
051223753980			Structural steel member, 100-ton project, 1 to 2 story building, W18x106, A992 steel, shop fabricated, incl shop primer,	378	L.F.	$158.59	$59,947.02

			bolted connections				
Division 05 Metals Subtotal							**$292,599.15**

Printer Friendly Print Cancel

To view the Printer Friendly Version you'll need Adobe Acrobat Reader installed on your computer. To download click on the link below.

Get Adobe Acrobat Reader

Appendix C

General Conditions Estimate

General Conditions Estimate	
Non Personnel Expenses	$596,305.00
Primary Personnel	$3,542,000.00
TOTAL	$4,138,305.00

GC non Personnel Actual vs Estimated	
Actual Cost	Estimated Cost
$990,000.00	$596,305.00

Primary Personnel				
Activity	Quantity	Units	Unit Rate	Total Cost
Project Executive	3080	MHR	140	$431,200.00
Sr. Project Manager	3080	MHR	125	$385,000.00
Superintendent	3080	MHR	100	$308,000.00
Superintendent	3080	MHR	100	$308,000.00
Superintendent	3080	MHR	100	$308,000.00
Project Manager	3080	MHR	90	$277,200.00
Project Manager	3080	MHR	90	$277,200.00
MEP Coordinator	3080	MHR	90	$277,200.00
Assistant Project Manager	3080	MHR	55	$169,400.00
Cost Engineer	3080	MHR	90	$277,200.00
Project Scheduler	3080	MHR	100	$308,000.00
Project Accountant	3080	MHR	70	$215,600.00
TOTAL				$3,542,000.00

Non Personnel Expenses				
Activity	Quantity	Units	Unit Rate	Total Cost
Project Signs	17	Mo	1200	$20,400.00
Tool Rentals	17	Mo	500	$8,500.00
Housing Expenses	17	Mo	6650	$113,050.00
Travel Expenses	17	Mo	6000	$102,000.00
Meeting Expenses	17	Mo	525	$8,925.00
Office Trailers - Set Up	1	LS	12500	$12,500.00
Office Trailers - Rental	17	Mo	2400	$40,800.00
Electric - Consumption	17	Mo	600	$10,200.00
Water & Sanitary Consumption	17	Mo	250	$4,250.00
Alarm - Set-up	1	LS	1500	$1,500.00
Alarm - Monthly	17	Mo	200	$3,400.00
Telephones - Monthly	17	Mo	1125	$19,125.00
Mobile/Cellular	17	Mo	100	$1,700.00
Stationary & Supplies	17	Mo	1150	$19,550.00
Copier	1	LS	52500	$52,500.00
Fax Machine	1	LS	2500	$2,500.00
Business Machine Maintenance	17	Mo	250	$4,250.00
Computer Equipment	17	Mo	3110	$52,870.00
Progress Photos	17	Mo	625	$10,625.00
BIM services	1	Allow	40000	$40,000.00
Personal Protective Equipment	1	LS	11250	$11,250.00
Porta - Johns - On Grade	17	Mo	1450	$24,650.00
Office Trailer Removal	1	LS	23260	$23,260.00
Temp. Storage Trailers	17	Mo	500	$8,500.00
TOTAL				$596,305.00

Appendix D

LEED Score Card

LEED 2009 for New Construction and Major Renovations

Project Checklist

West Fuala Plant Expansion

04.30.2010

Sustainable Sites

Y	?	N			Possible Points: 26
7	2	17		Sustainable Sites	
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
		5	Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
		6	Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
3			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
1			Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
	1		Credit 6.2	Stormwater Design—Quality Control	1
		1	Credit 7.1	Heat Island Effect—Non-roof	1
	1		Credit 7.2	Heat Island Effect—Roof	1
		1	Credit 8	Light Pollution Reduction	1

Water Efficiency

Y	?	N			Possible Points: 10
6	4			Water Efficiency	
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
	2		Credit 2	Innovative Wastewater Technologies	2
2	2		Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere

Y	?	N			Possible Points: 35
	8	27		Energy and Atmosphere	
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
	1	18	Credit 1	Optimize Energy Performance	1 to 19
		7	Credit 2	On-Site Renewable Energy	1 to 7
	2		Credit 3	Enhanced Commissioning	2
		2	Credit 4	Enhanced Refrigerant Management	2
	3		Credit 5	Measurement and Verification	3
	2		Credit 6	Green Power	2

Materials and Resources

Y	?	N			Possible Points: 14
10		4		Materials and Resources	
Y			Prereq 1	Storage and Collection of Recyclables	
3			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
2			Credit 4	Recycled Content	1 to 2
2			Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Indoor Environmental Quality

Y	?	N			Possible Points: 15
5	3	7		Indoor Environmental Quality	
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
		1	Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
		1	Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
	1		Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
		1	Credit 6.1	Controllability of Systems—Lighting	1
		1	Credit 6.2	Controllability of Systems—Thermal Comfort	1
		1	Credit 7.1	Thermal Comfort—Design	1
	1		Credit 7.2	Thermal Comfort—Verification	1
		1	Credit 8.1	Daylight and Views—Daylight	1
		1	Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process

Y	?	N			Possible Points: 6
4	2			Innovation and Design Process	
	1		Credit 1.1	Innovation in Design: Specific Title	1
1			Credit 1.2	Innovation in Design: Specific Title	1
1			Credit 1.3	Innovation in Design: Specific Title	1
1			Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits

Y	?	N			Possible Points: 4
	2	2		Regional Priority Credits	
		1	Credit 1.1	Regional Priority: Specific Credit	1
		1	Credit 1.2	Regional Priority: Specific Credit	1
	1		Credit 1.3	Regional Priority: Specific Credit	1
	1		Credit 1.4	Regional Priority: Specific Credit	1

Total

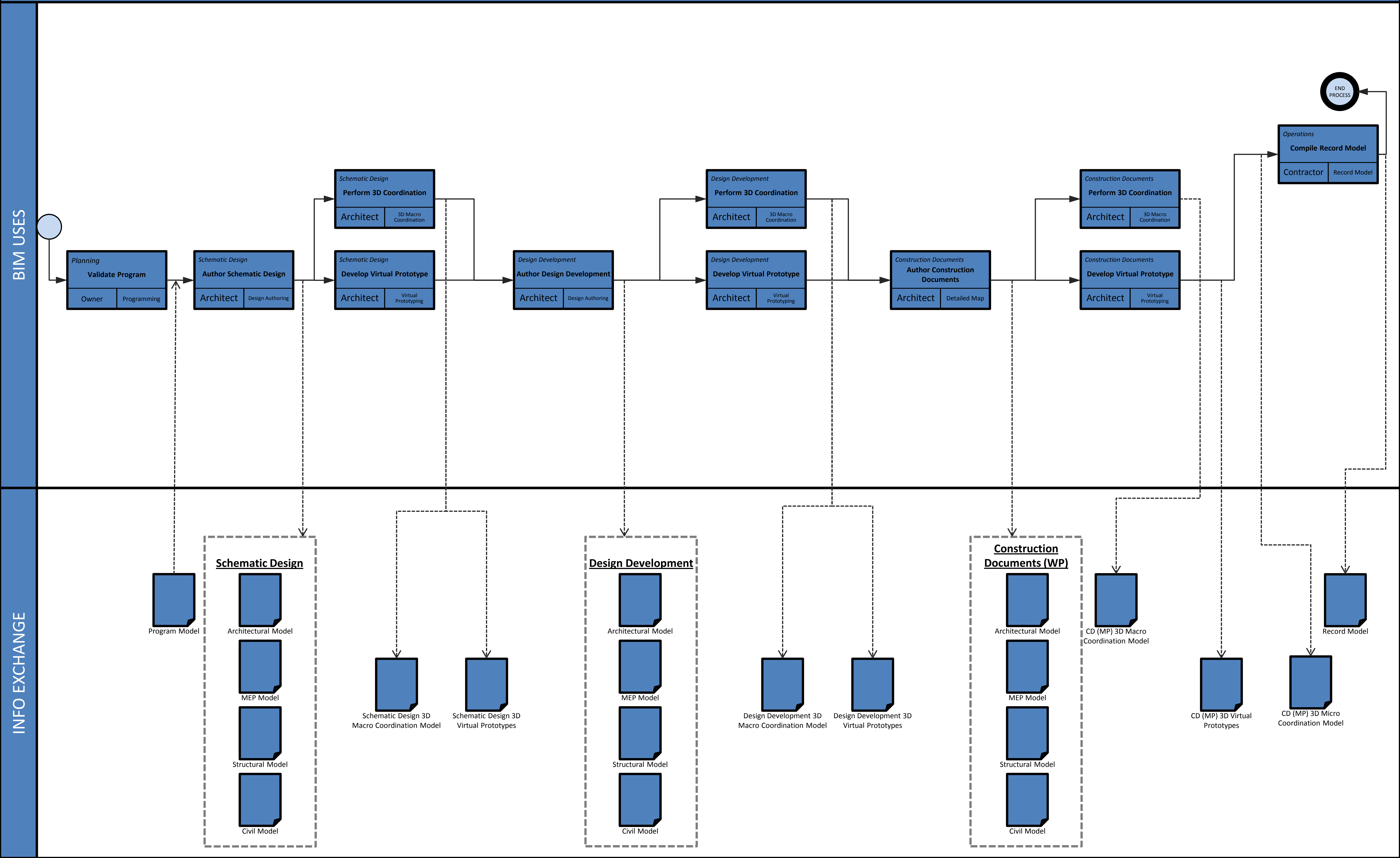
Y	?	N			Possible Points: 110
32	21	57		Total	

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Appendix E
BIM Worksheets

LEVEL 1: BIM EXECUTION PLANNING PROCESS
The West Fuala Plant Expansion

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team
http://www.engr/psu.edu/ae/cic/bimex



BIM Goals Worksheet

Priority (1-3)	Goal Description	Potential BIM Uses
1- Most Important	**Value added objectives**	
1	Minimize field clashes, Increase construction productivity, decrease construction time	3D Coordination
2	Increase Field Productivity, Facilities management purposes (storage of O&M manuals, warranties, record drawings, shop drawings, etc)	Asset Management, 3D Coordination

BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes	Proceed with Use
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)					YES / NO / MAYBE
				Resources	Competency	Experience			
Asset Management	MED	OWNER	HIGH					Facilities management purposes	**YES**
Building Systems Analysis									**NO**
Record Modeling									**NO**
Cost Estimation									**NO**
4D Modeling									**NO**
Site Utilization Planning									**NO**
Layout Control & Planning									**NO**
3D Coordination (Construction)									**NO**
Engineering Analysis									**NO**
Site Analysis									**NO**
Design Reviews									**NO**
3D Coordination (Construction)	HIGH	Contractor	HIGH					Implements meetings to ensure 'Clash free'	**YES**
		Subcontractors	HIGH				Learning how to use Clash-detection program	Modeling learning curve possible	
		Owner	HIGH						
Existing Conditions Modeling									**NO**
Design Authoring									**NO**
Programming									**NO**

* Additional BIM Uses as well as information on each Use can be found at http://www.engr.psu.edu/ae/cic/bimex/